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PACK-SADDLES.

PATENT OF CAPTAIN H. R. NEWBURGH-STEWART, R.N.

BY J. C. KING.

THE word pack-saddles has an archaic ring about it with ordinary readers, recalling old world travelling, and with the more recent use of such things, as late as the Abyssinian and Egyptian wars; but readers, who are travellers, know that in some parts of the world a pack-saddle is one of the most important means of aid for the transit of goods from distant parts to their destinations: perhaps as many as a million are in constant use in commerce. Even armies depend, for the transport of guns, stores, and munitions of war, on the pack-saddle, on the backs of either horses, mules, camels, or donkeys, in many parts of the world. Without it the human shoulders would have to serve the purpose, as in very primitive times. The British Government's Stores contain nine different sorts and sizes of pack-saddle for military use. They are classified as follows:—

Pack-Saddles—Artillery.

No. 1...R.M.L., 2·5
„ 2... „ 3·3 Jointed Howitzer.
„ 3... „ 4 Howitzer.
„ 4... „ 7 per 200 lbs.
„ 5...Donkey Pack-saddles.

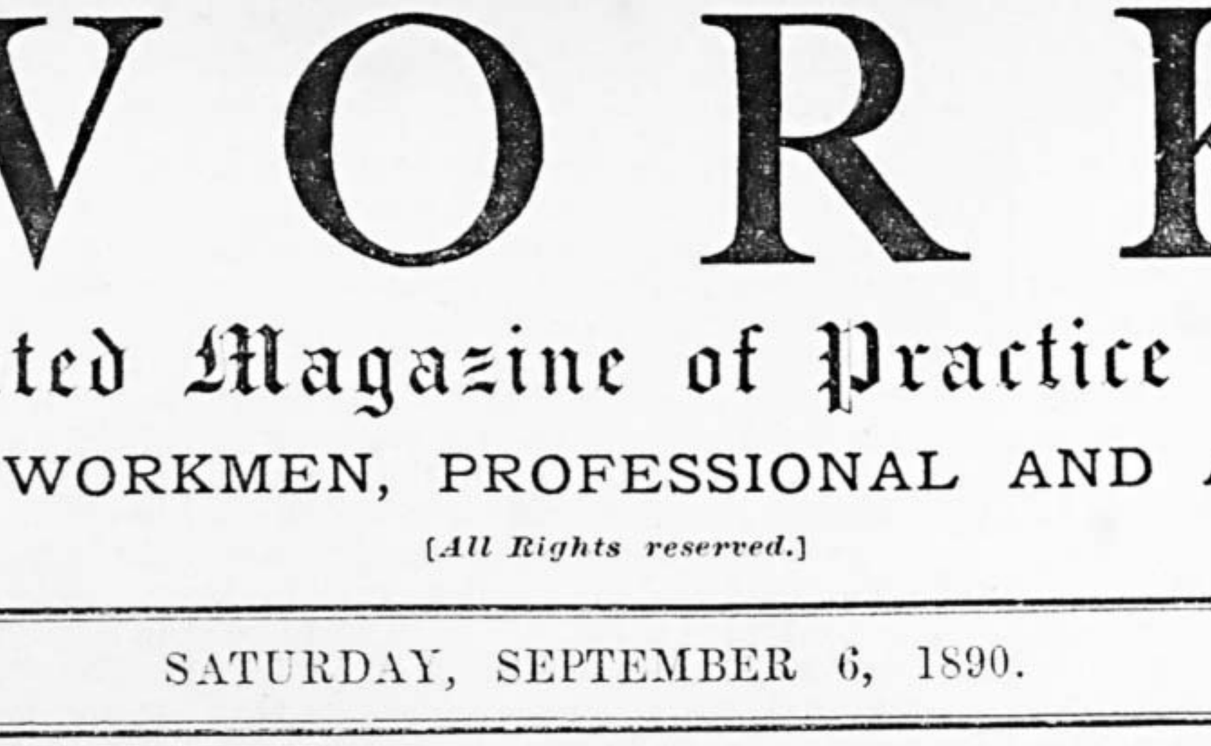

Fig. 4.—A A, Lower Edge of Aparejo; B B, Showing where the Aparejo rests on the Mule's Back; H H, Showing where the "Riata" is tightened upon the Load; G, The Crupper; E, Corner of Sweat Cloth; C, The Corona; D, Synch; F, Loose End of the "Riata," 60 Yards Long.

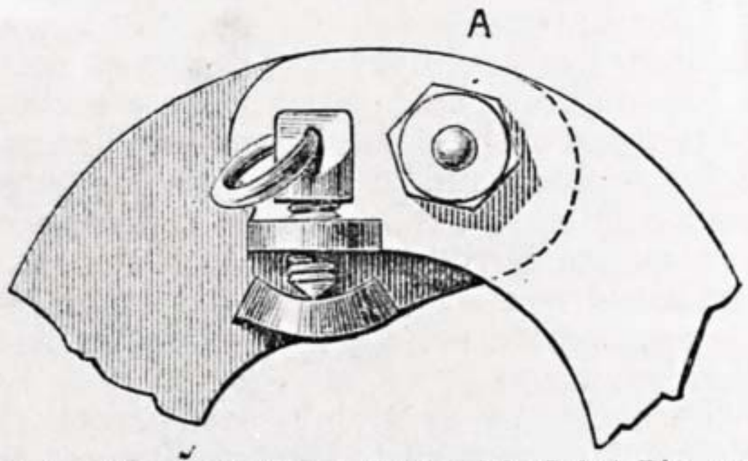

Fig. 1.—Joint of Metal Tree with Joint-Pin and Nut (A).

General Service Pack-Saddlery.

No. 6...Mark II., Large.
„ 7... „ Small.
„ 8...Mark III., Large.
„ 9... „ Small.

The first four pack-saddles indicated above, it will be seen, are employed for the transport of guns, whole or in parts, ammunition, etc. They are distinguished by having solid heavy iron clamps fixed to the "tree" framing to hold the heavy weights loaded on them. The donkey pack-saddles, and general service ones, are without these clamps, but they have an iron "tree" of great weight, but uncertain strength, in shape somewhat like a Saint Andrew's Cross, one angle clipping the back of the animal, the other angle upstanding to receive any stores that can be strapped on to this iron frame. The very first impression derived from this description is, how can the unyielding iron angle ∧ fit animals that vary so much in size of barrel as horses, mules, and camels? Behold! nine sizes! is the ready answer; but if animals vary in nine degrees, and vary continuously on the march of an army, by the arrival of fresh animals they must be fitted somehow, though a dominant number of either large or small animals are presented for use: changing loads or transferring saddles, like giving change in a chandler's shop, is the result, not now and then, but incessantly.

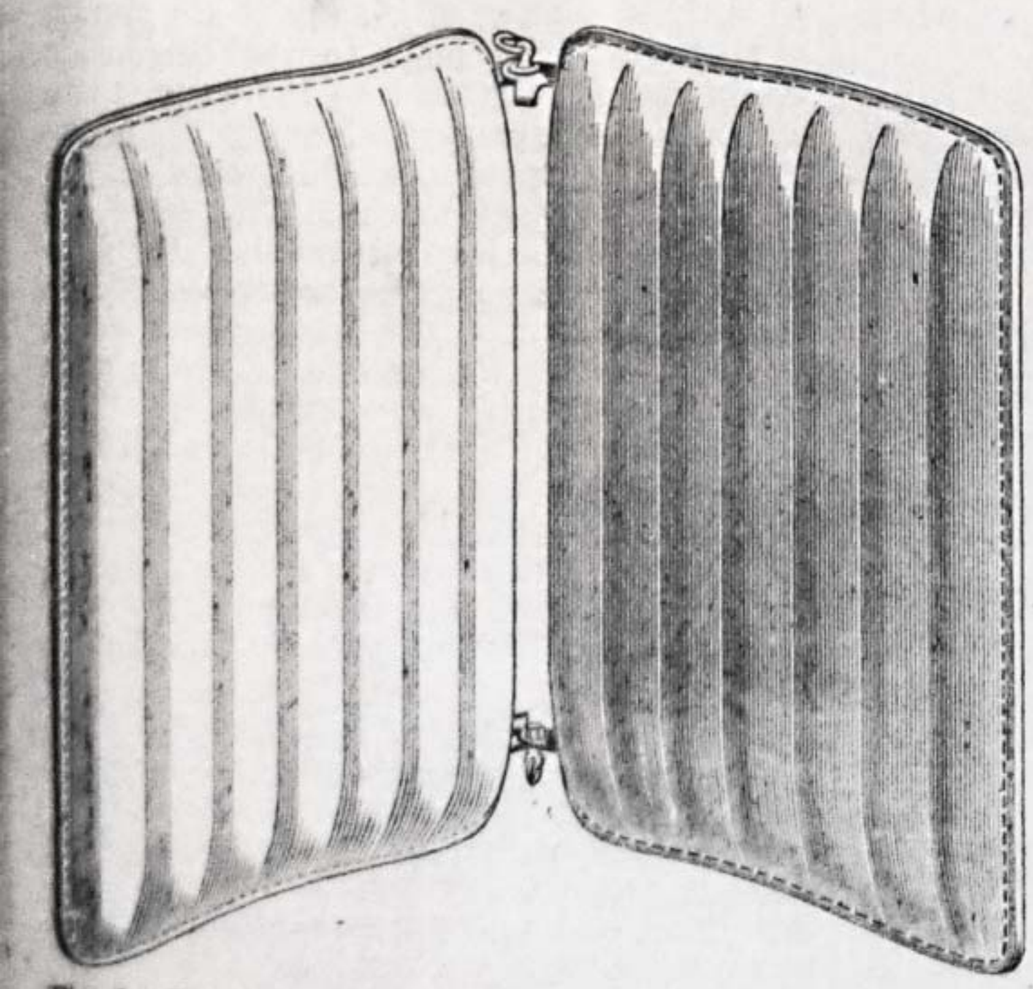

Fig. 3.—Panels stuffed with Cork arranged in Horizontal Ribbing for Ventilation, showing Under Side.

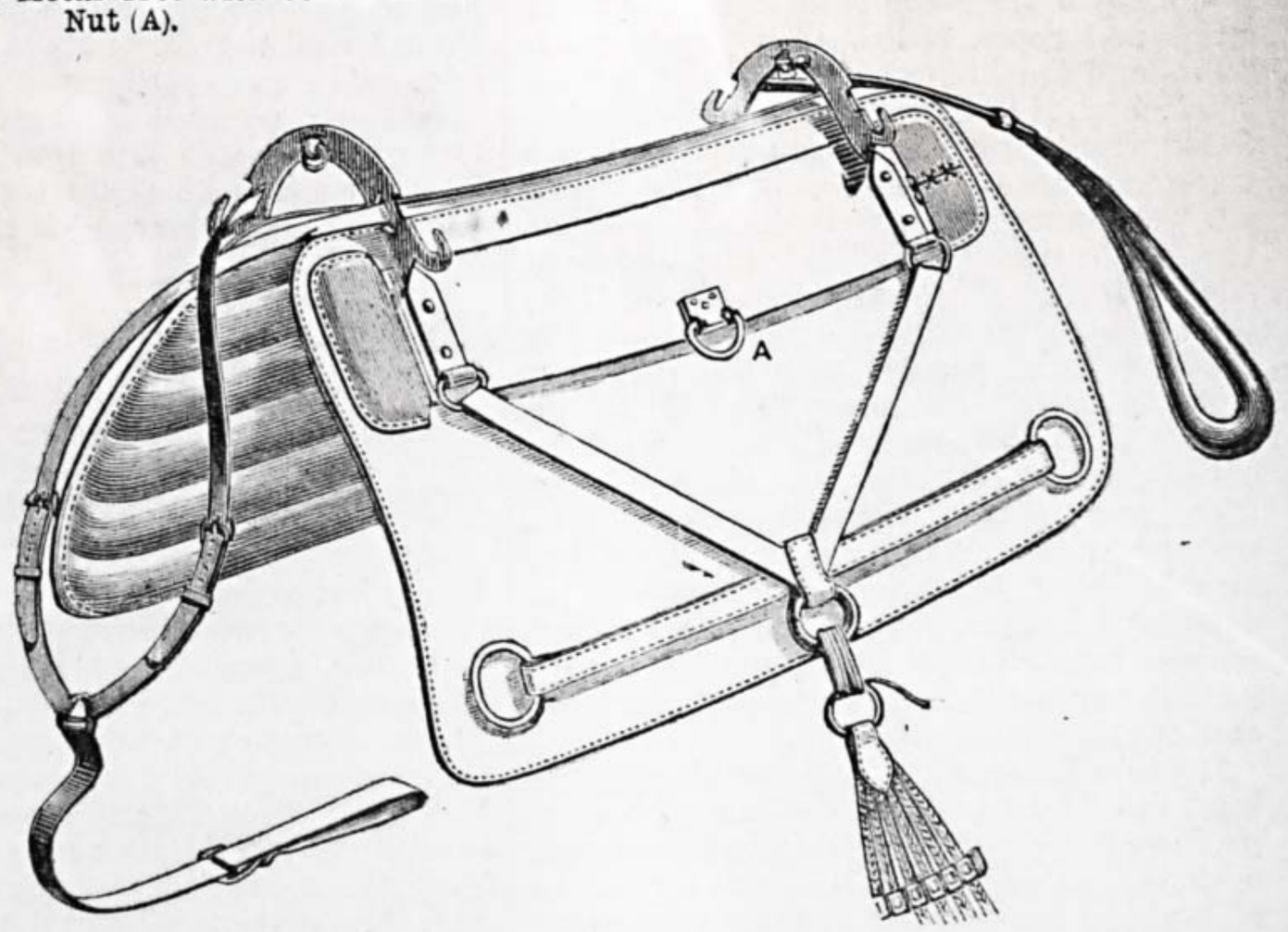

Fig. 2.—Pack-Saddle, showing Metal Trees above Panels, Tie-bars, etc., and Ring (A) placed on the Bars of the Tree for Girthing up to a Donkey.

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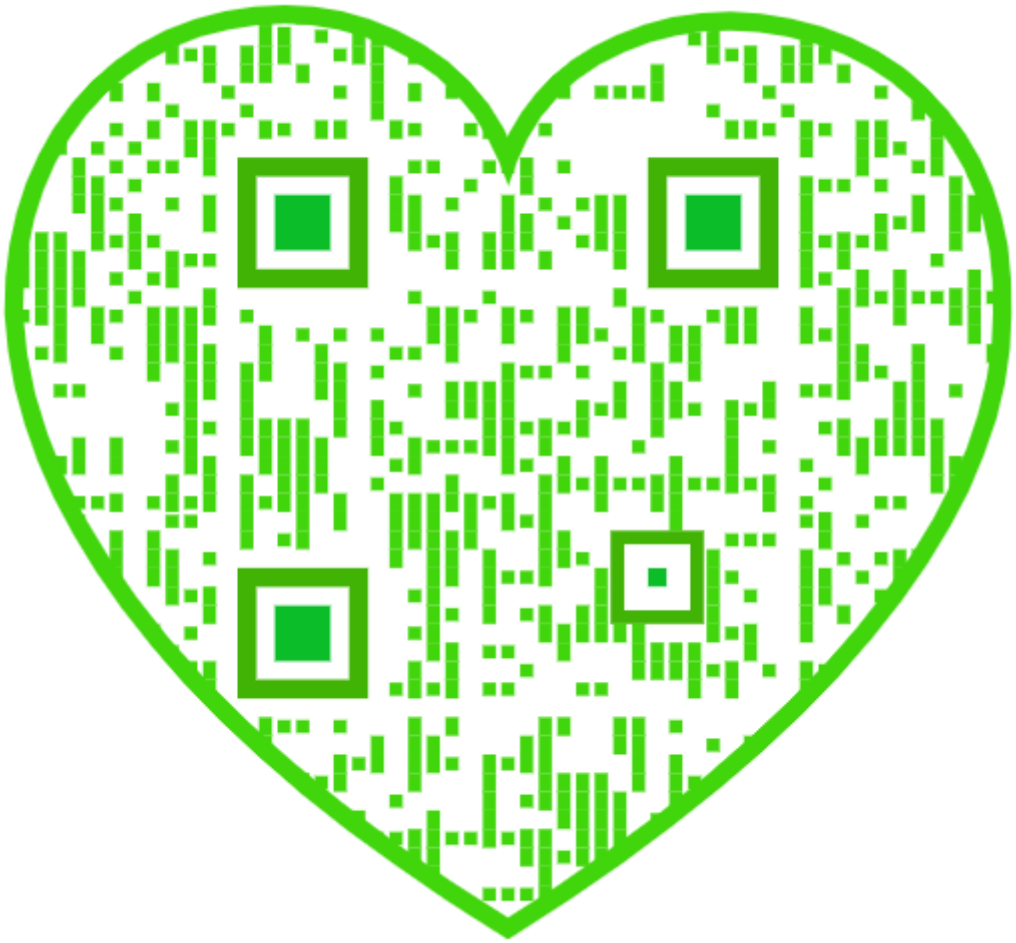

This is non-military, yet it is the rulé; and the cost in labour, time, and the good *morale* of fighting-men can be imagined, where some of the essential materials of combat are left to chance medley like this.

Take the weight of the full-size pack-saddles, 54 lbs. This is an excessive weight to carry only about 200 lbs. Surely, in these days of light equipment of armies on the march, this amount of weight might be lessened by the use of suitable metal, as steel, or some of the alloys of bronze.

Pack-saddles being out of the ordinary range of every-day manufacture, governments are constrained to rely on their own resources for contrivance and construction. But there are travellers and skilful mechanics who have used pack-saddles of simpler and lighter make. Perhaps foremost of all is Captain H. R. Newburgh-Stewart's, R.N., whose world-wide journeyings, and a life of nine years under canvas, give ample warranty for assumption of merit in any contrivance he may offer for notice—to simplify the make, economise the cost, and lessen the weight of pack-saddles for army or commerce. Travellers do not take nine different size pack-saddles about with them, though their *impedimenta* is often as heavy and awkward as army stores. The wooden "tree," packed out with rugs to make the big or little pack-saddle fit the little or big animal—camel, mule, or donkey—this was, and is, the usual traveller's plan, but it is not Captain Stewart's plan. He has chosen galvanised manganese steel for his "tree" frame, and shaped it like a pair of callipers, to open and close to the size of the animal, be it camel, mule, or donkey. The ingenuity of easily altering the size, and securing it fixedly in one position of span for the size wanted, is as simple as it is effective. Fig. 1 shows the joint of the metal "tree," with a joint-pin and nut A. On each of the jointed framings near A is a lug: one has a screwed nut through it to act on the other lug at its point; this nut, when turned, causes the curved "trees" to open or close. Fastening the "tree," when adjusted to the animal's back, is done by screwing up the hinge nut A by the hand. This is the leading feature of a simple, yet effective, invention; but it at once determines the whole strength and lightness of the pack-saddle, built upon two of these metal "trees" and two tie-bars. They weigh, with their complete complement of straps and ropes, 11 lbs. The panels weigh 7 lbs., and the lining or "numnah" weighs 3 lbs.; total, 21 lbs. (Fig. 2.) It is only natural to suppose that collateral improvements are made in panel and "numnah.' The panels are the source of sore backs, as well as the ill-shaped "trees" of the ordinary pack-saddles. They are usually of felt, wool, skin, or matting—in fact, anything is supposed to be good enough to go next an animal's back. These are pressed by the weight tight on the animal's skin, and there act as a sucker or blister, and if the load be lifted, and the back exposed to the chill of a draught of air, inflammation is set up, and incipient blistering occurs, which is confirmed by the renewal of the sucking process and chilling exposure, till a sore back is the result, and the animal has to be cast out as useless till cured.

Captain Stewart supplements his expanding "tree" by panels of waterproof canvas, made up like corduroy, forming a corrugated, or fluted, surface, which allows the air to be pumped through the channels with every motion of the animal, so that no sucking action or heating process takes place. The ribs of canvas of the panels are stuffed with granular cork, hence their lightness—3½ lbs. each—making them buoyant in water (Fig. 3), saving the moving of the unloaded pack-saddle in swimming animals across streams.

It is mainly as a merchant's vehicle for the transport of goods that its high merit will be found so essential for economy of cost, and valuable in saving the lives of pack animals. A mule with pack-saddle is shown in Fig. 4, and all the various parts fully described, and their actions explained.

The load in Fig. 4 is supposed to represent four 50 lb. sacks of flour.

It is usual to pile smaller packages that are not very heavy betwixt the sacks, upon the centre of the aparejo. This has been purposely omitted in the cut, in order to show how the riata acts in securing the load. (Note.—After the riata or baggage rope is passed, there would be hardly any breakage strain on the adjustable pack-saddle joint.) When the pack-saddles are parted at the jointing, they are packed more closely, saving much in freightage.

Adjustment of Saddle.—(1) Loosen the centre screw, and contract the "tree" as much as possible. (2) Then place the saddle on the animal's back, and expand the "tree" with the side adjusting screw (shown in Fig. 1) until the saddle is properly fitted. When adjusted, screw up the centre screw.

This pack-saddle has the exceptional advantage of being suited for use as a riding saddle, being supplied with safety latches to take stirrup leathers, hung on the side bars of the "tree." This is not possible with any other pack-saddle that is made. Its importance, from a military or commercial point of view, cannot be over estimated.

In the large display of pack-saddles from all parts of the world at the late Paris Exposition, the crudeness of design and patched-up make was obvious, the French military pack-saddles being no exception.

The military authorities there are about to test one of these patent pack-saddles, and a large merchant in Turkey, using many pack-saddles (if they can be called such), is about to introduce them in that part of the world, so that wayfarers and merchants may anticipate reaping some benefits from this invention.

Recently, by special request from the French Government to Captain Stewart, the patent pack-saddle was sent through the French Embassy for trials in France, which are now being carried out.

In India, where it has been fully tried in General Roberts's late tour of inspection, it was considered a great success by the Indian officers, who tried it thoroughly.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

THE MAINSPRING: ITS NATURE AND TREATMENT.

IN my last article I referred to the common fallacy respecting the cleaning of watches, and now I must allude to certain other fallacies which are even more widespread. There is among some people an idea that a watch mainspring which easily breaks is a bad one. Even among men who consider themselves practical hands I have often heard this idea expressed. In point of fact, the exact opposite is the true case. A bad mainspring seldom breaks; a good one often does. The reason becomes obvious the moment the facts are stated. An ordinary watch mainspring as it comes from the maker's hands measures in length about twenty-five or thirty inches. The spring generally requires shortening before being fixed into the watch, but not to any great extent. When loose and in its natural state, the mainspring forms a coil as large, perhaps, as the palm of one's hand, and this has to be tightly wound up and put inside the barrel, which is a little round brass box, probably the size of a shilling, or much less, in diameter.

The great object aimed at in a good mainspring is elasticity and power. A common mainspring, when wound up into the narrow compass of a small barrel or drum, loses all its vitality, and remains cramped and feeble. When it is drawn out of the drum, it scarcely expands beyond the limits within which it has been accustomed to work. But a first-class mainspring is totally different. It is like the story of the fisherman in the "Arabian Nights," who brought up a vase from the bottom of the sea with his net. He set the vase down before him, and while he was attentively observing it there issued from it so thick a smoke that he was obliged to step back a few paces. When the smoke had all come out of the vase, it again collected itself and became a solid body, and took the shape of a genie of a gigantic size. The genie, looking at the fisherman, exclaimed, "Humble thyself before me, or I will kill thee!"

A fine mainspring is instinct with life and love of liberty, and when it is drawn out of the drum, it expands with one bound to its original size.

For good time-keeping purposes it is such a spring as this which is required. But mainsprings that possess so much vitality are very highly tempered, and are extremely liable to break. Common ones, on the other hand, being soft and pliable, rarely break. But as the object of a spring is to be springy, a soft spring is no good. The only alternative is to adopt a fine spring and take the risk of breakage. I have seen as many as four and five mainsprings break merely in winding them into the barrel. They rebelled against being robbed of their liberty and cramped up in the drum of a watch. But a little judicious coaxing is necessary in order to tame their fiery spirit. Great care must be taken that the end of the mainspring winder is as nearly as possible the exact size of the eye of the spring, so that when you begin to wind the spring up in order to get it into the barrel there will be no sudden wrench or change in the shape of the eye. And before being put upon the winding machine the eye of the spring should be carefully manipulated with a pair of concave pliers to the size of the barrel arbor. The eye having been made the proper size, the handle of the winder should be turned very cautiously. The more slowly the mainspring is wound into the barrel the better, for a spring of high temper is always liable to break with rough treatment. But a common spring, which is to a great extent like crinoline steel, will go on almost for ever, without any danger of breakage.

One important matter in the preservation of the mainspring is the careful use of the key during the operation of winding. Many people when winding treat a watch like a roasting-jack. They hold the watch in the left hand and move it half round as they wind, while with the right hand they twist the key as rapidly as they are able to do. Nothing could be more injurious than this

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very general custom. The watch should be held perfectly still while winding, for if it is moved round, the motion given to it will interfere with the rotation of the balance or fly-wheel, and that very materially interferes with the time-keeping qualities of the instrument. The key also should be used carefully, the winding being performed with a slow and steady pressure. A watch-key should never be kept in the pocket, where it gets full of dust and dirt, which falls into the works when winding. The key should be kept in the bedroom in a clean and dry place. The same caution may be wisely exercised in relation to pendant winders or keyless watches. But in this class there is not the same danger of breaking the spring by rough usage, for the reason that, owing to the construction of the keyless work, you cannot wind so fast and so abruptly as with a key winder. A great deal might be written about the mainspring itself, for there are many qualities and many makes. But that is scarcely my purpose. At the same time, I may as well throw out a few hints which may prove useful, more particularly to amateurs. Mainsprings are practically all made in Switzerland. They are sold in bulk at prices varying from, say, 12s. a gross and upwards. A good average mainspring is bought in wholesale quantities at 24s. per gross, and sold at the material shops at fourpence each. Taking into consideration the trouble of fitting and the loss by rust and from other causes, the charge of fourpence is very reasonable. For ordinary jobbing purposes this class of mainspring is quite good enough; but for the finer work a fourpenny mainspring is not of sufficiently good quality. Some of the London material depôts fit a really first-class mainspring for one shilling, and the barrel can be sent up from the country by post, so that the jobber obtains a beautiful spring fitted with precision. One of the salient advantages of a fine mainspring is that, to use a paradox, while it is weaker it is stronger. The steel of which it is made is thinner than that of a common spring, and for all that it exerts more power owing to its fine temper and the trueness and smoothness of its make. The ideally perfect watch is one that will carry the largest possible weight, in the shape of a balance wheel, with the smallest possible motive power, in the shape of the mainspring. The ideally imperfect watch is one that carries the smallest possible weight in the shape of a balance wheel, even when driven by the most powerful mainspring.

English watch manufacturers have in the past been very great sinners in regard to the proportions of the ideal watch, but in recent years there has been a most marked improvement. Upon this point, however, I shall be glad to enlarge on some future occasion should any readers be anxious to hear more about this particular part of my subject. At any rate, I may say that the mainspring plays a vital part in the organisation and performance of a watch. Perhaps, therefore, I cannot do better than close this article with a homely illustration of my meaning.

Suppose there is a certain piece of heavy work to be accomplished. You pick out to perform the work a big, heavy, powerful-looking man. Before he has proceeded very far you discover that he is all blubber and no muscle. He tears away, doing injury to himself and to everything around him, but with little result. Then you select a thin-looking, compactly built man, whose muscles have been highly trained, and whose excess of unnecessary fat has been all removed by exercise. Such a man will do double the work of the former man with half the fatigue. The man of blubber, I need scarcely say, is like the common mainspring, while the man of muscle is like the fine one.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

THE "LITTLE WONDER" EXTRACTOR.

IT is generally admitted that a modern apiary cannot be profitably "run"—to borrow an expressive term from our American cousins—without employing an extractor. I therefore give this piece of apparatus a prominent position in the present series of papers, taking it after the hives and ever-wanted smoker.

There are two forms of extractor, very different from each other both in style and price; the "Little Wonder," invented by Mr. Abbott, and the "Cylinder Machine."

The principle, however, is the same in both; the honey being compelled to leave the cells by centrifugal force, just as the water is driven from a mop by whirling it violently.

In the "Little Wonder," the can (seen in Fig. 1) is whirled round the handle, the latter revolving on the spike shown in the lower end, which is stuck into the floor; and the loose piece on top which turns on a long spike driven into the top of the handle. The honey passes through the netting, shown in Fig. 1, into the can, and may be poured out through the neck C on top when desired. The netting is a very important item, its object being to prevent the comb breaking from the frame and following the honey into the can. It should therefore be kept very taut and rigid; and this is one of the difficult problems in connection with the extractor.

No zinc or galvanised iron should, on any account, be used in the manufacture of any article which is to contain or come in contact with honey. The consequences of the neglect of this rule might be very serious. Even the netting should be of tinned iron, not galvanised.

The cost of the materials for this extractor is very little, about two shillings in all; and, as the cheapest that could be bought would cost seven shillings and sixpence, the amateur would be well repaid for his time; and if he uses the best materials, will have a superior article.

Three sheets of the boat tin, twelve inches by eighteen—which we used for the Bingham smoker—will be more than enough. We will require, also, the handle, four feet two inches by one inch and three-quarters square, and some eighth of an inch iron wire.

Take one of the sheets of tin and scribe the line A B (Fig. 2) along the middle, five and a quarter inches from one edge. Then, with its centre on this line, draw an arc of a circle, having its radius eight inches. Complete the construction to the dimensions given in Fig. 2; the extreme breadth being ten and a half inches, and the complete length eight and a quarter, slack. The inner lines are to be drawn a quarter of an inch from the others, with the exception of the long, straight sides which have the inner lines three-eighths from the edge.

The tin may now be cut with the snips to the outer lines, and the six pieces M taken out. Fig. 3 is to be marked and cut just in the same manner, both pieces differing only in length. The long, straight edges may now be wired with straight pieces of wire nine and three-quarters long, and all the other edges turned up along the lines at right angles to the broad part. The back is simply a bit of tin eleven and a half inches by seventeen; but, when a quarter of an inch is turned in at the edges to fasten it to the wings B, B (Fig. 1), it will be reduced to eleven inches in breadth, and will thus fit nicely the curved lines of the top and bottom. The wings B, B, are three inches wide; when finished, therefore, the strips of tin for their manufacture will be seventeen and three-eighths by three and five-eighths to allow for wiring the front edges and tops, and for the lap joints to the back.

The best method of procedure is, I think, to cut out the back and wings to the sizes given, turn out the edges of the back, wire the front edges and tops of the wings, turn in the other long edges, hook them into the back, hammer down, and then run a little solder along the joints. The back is then to be bent to the curve of the top and bottom, and secured to them with solder; the wings, also, being firmly fastened on. When all the soldering has been satisfactorily done inside, the low front (A, Fig. 1) may be bent up along the line C D (Fig. 2), and the turned-up edges will fit over the wings and be soldered to them, thus forming a receptacle for the honey. At this stage, a three-quarter-inch hole may be bored, and a tapered tube of tin made and soldered in, as at C (Fig. 1). The tin tube should not project into the extractor, or all the honey would not pour from it. It should therefore be flush with the inside.

The body, now, is complete and ready for the netting. This is removable, and secured to a light, wooden framework, the outside dimensions of which are nine and a half by sixteen and a half by an inch and a half deep. It is made of half-inch pine. It is nailed together firm and square, the centre member being planed to an edge so as not to impede the honey when leaving the cells. A bit of wood nailed along the lower edge prevents the frame from falling down too far, and keeps the comb opposite the netting. Fig. 4 represents the netting and its frame. They should be attached together with a number of little staples, each wire, or two if they cross, having a separate staple. I need scarcely say that the netting should be very tight. The piece required will be nine inches by fourteen and a half, and would be supplied by most makers of hives. Its price I cannot say at present, but I hope to be able to do so before these papers are completed.

When the frame is in place the netting will be on a level with the front edge of the top, and an inch and a half distant from the wired edges of the wings. This is the space allowed for the thickness of the comb, so, if two inch sections are required to be extracted, the wings must be either half an inch wider or the frame for netting half an inch narrower. The frame will fit firmly against the back, and will require to be slightly rounded at the edge for that purpose.

A light shutter of wood E, Fig. 5, slips down over the wired edges of the wings and covers in the comb during the process of extraction. This is only shown in section in Fig. 5 at E. Its dimensions are fifteen and a half

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by nine and three-quarters by a quarter thick. Two little cleats are nailed across it; and the upper one, F, Fig. 5, two inches from the top of the shutter, is long enough to permit its shoulders to catch the strap which holds the body and handle together. The lower cleat is cut short so as to allow the shutter to be slipped down into place.

We now turn to the handle, for which nothing could be better than the piece of ash, which, in some districts, is used for a spade handle, and can be bought, square and undressed, for sixpence. It should be cut to three feet nine long, and planed square to inch and a half or three-quarters. The corners can then be planed off all along to the depth of a quarter of an inch. Four inches at one end may now be rounded and tapered until it reaches about an inch and a quarter in diameter, and a ferrule an inch long fitted to it. The next sixteen inches are left square, and the remaining two feet one inch rounded and tapered, as before, to one inch and a quarter and fitted with a ferrule. Holes are now bored through the axis of the handle to take the spikes. The lower one may be three or four inches long, driven in until only an inch is sticking out. This part is to be brought to a nice round blunt point. The spike at the other end may be nine inches long, and driven in until five and a quarter are left sticking out. Both spikes are of three-eighth round iron or steel.

Fig. 1.

A piece of wood five inches long must now have a hole bored axially through it, large enough to fit easily on the top spike and revolve on it. It is good practice to bore this with a three-eighth inch bit, and then burn it out with a piece of round iron the size of the spike. The burning hardens the wood and makes it work nicely. When bored it should be rounded to an inch and an eighth, and secured in place with a washer and a few taps of a hammer to slightly rivet the head. The rounding of this top piece as well as of the handle could be done with great ease and quickness in a lathe.

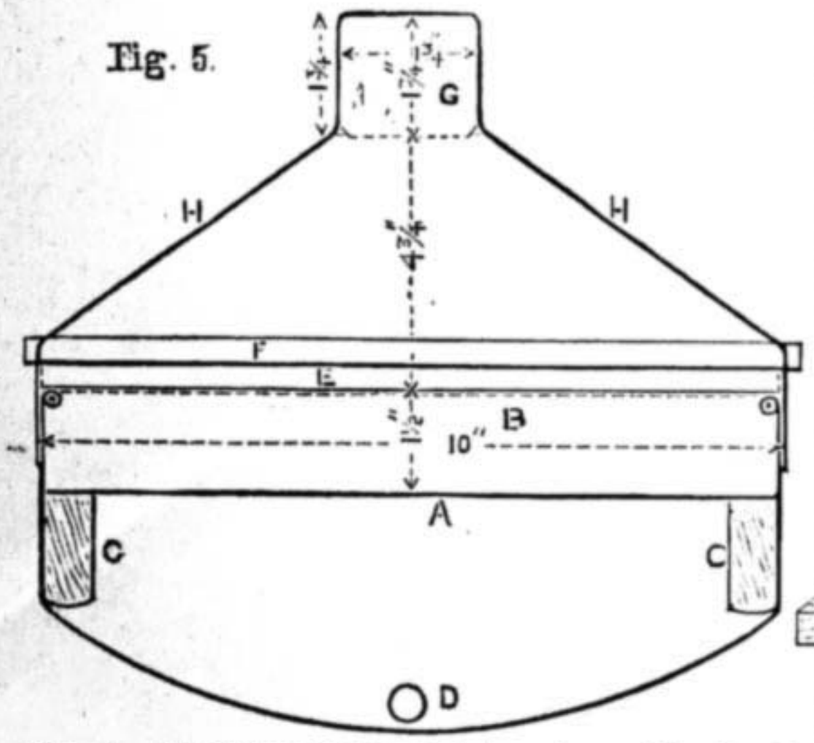

Fig. 5.

The body and handle being both complete, we must next prepare the straps with which they are held together. To do this, cut two strips of tin two and a quarter inches wide and eighteen long, wire them on both edges, and then bend them to the form shown at Fig. 5. The straps in this figure should be drawn full size on a bit of board, and bent carefully until they match it. They are then to be firmly soldered to the body, the lower edge of the lower strap being three inches from the bottom of the body and the straps eleven inches apart.

As Fig. 5 is a section through the body, it will explain the relative positions of the body, netting, comb, shutter, strap, and handle. An important measurement is the distance of the netting from the handle, which should be four and a half inches, or thereabouts, at their nearest surfaces.

The handle is secured to the strap by means of a short, large-headed screw at the back, and, if necessary, one at each side as well. From the point of the spike to the lower edge of the lower strap is four and three-quarter inches, and with this measurement the extractor can stand by itself, without leaning in a corner.

It would make the working much easier if a metal plate with a hollow in it were sunk in the floor of the manipulating house, or wherever the extractor is mostly used. The plate, which could be of cast iron, would be about three-eighths thick with a half-inch hole drilled nearly a quarter of an inch deep with a round-pointed drill. The rounder the bottom of the hole is the smoother it will work, but any hole will soon wear to the proper shape. A little oil dropped into it will make things go smoothly. To work this extractor the comb is uncapped with an uncapping knife, the uncapped side is laid against the netting, and the shutter slipped into place. The lower spike is then put into the hollow prepared for it, and a slight circular motion of the handle will make the body revolve rapidly, and the centrifugal force thus set up drives the honey from the comb. The machine should not be driven too quickly or the comb would probably be broken. When one side is extracted the other can be uncapped and placed in turn against the netting and emptied likewise.

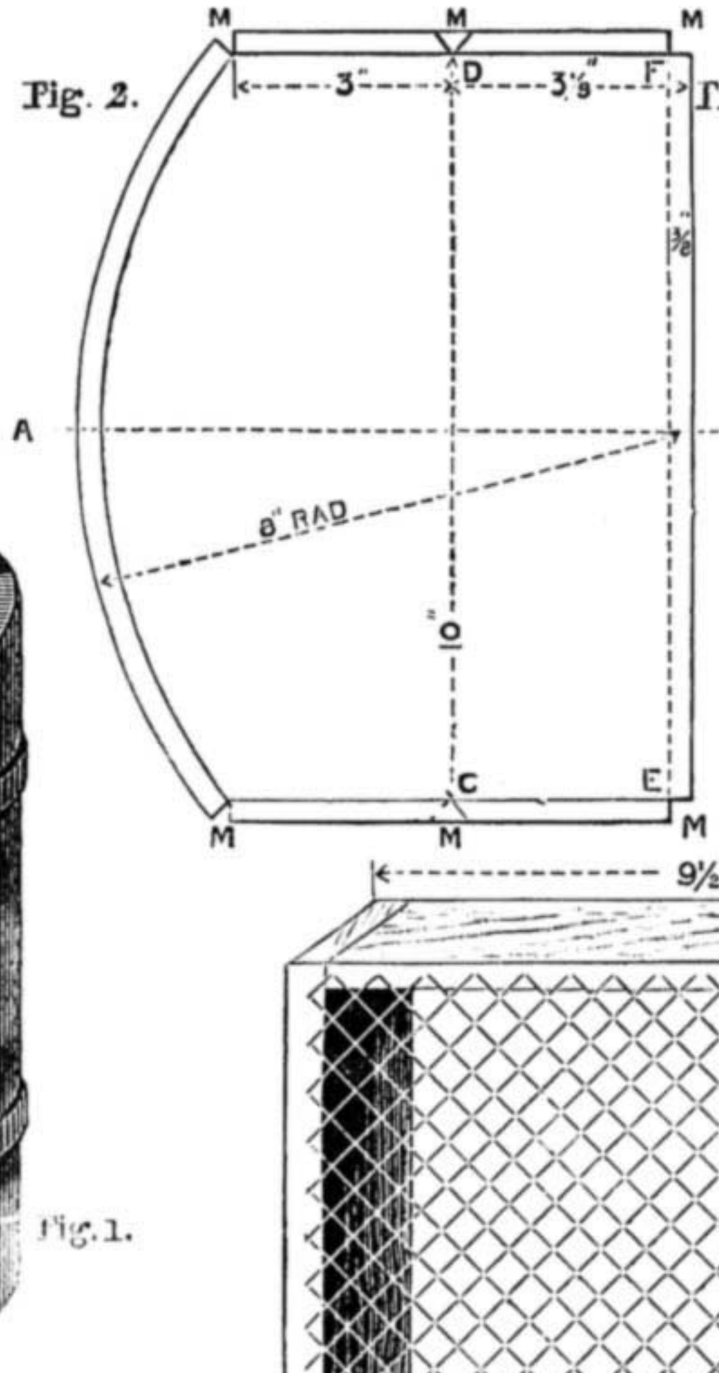

Fig. 2.

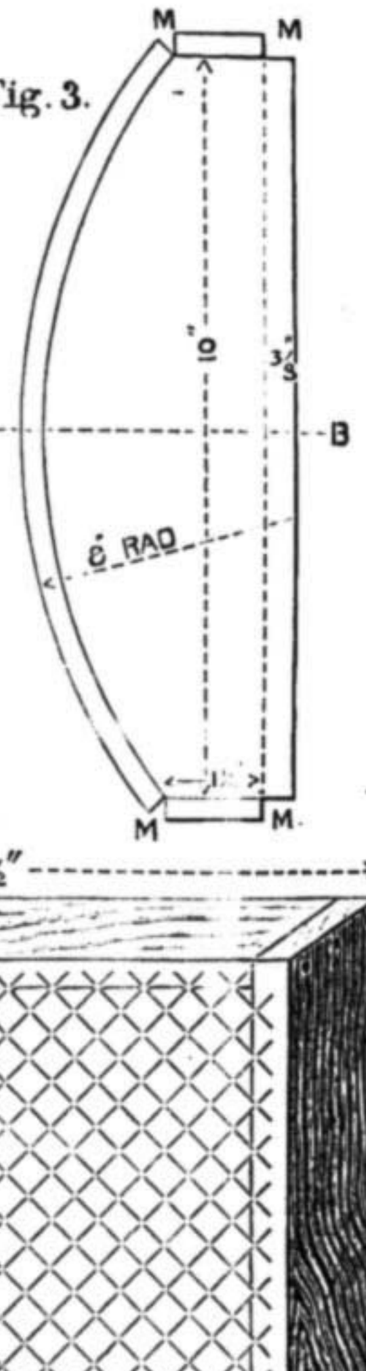

Fig. 3.

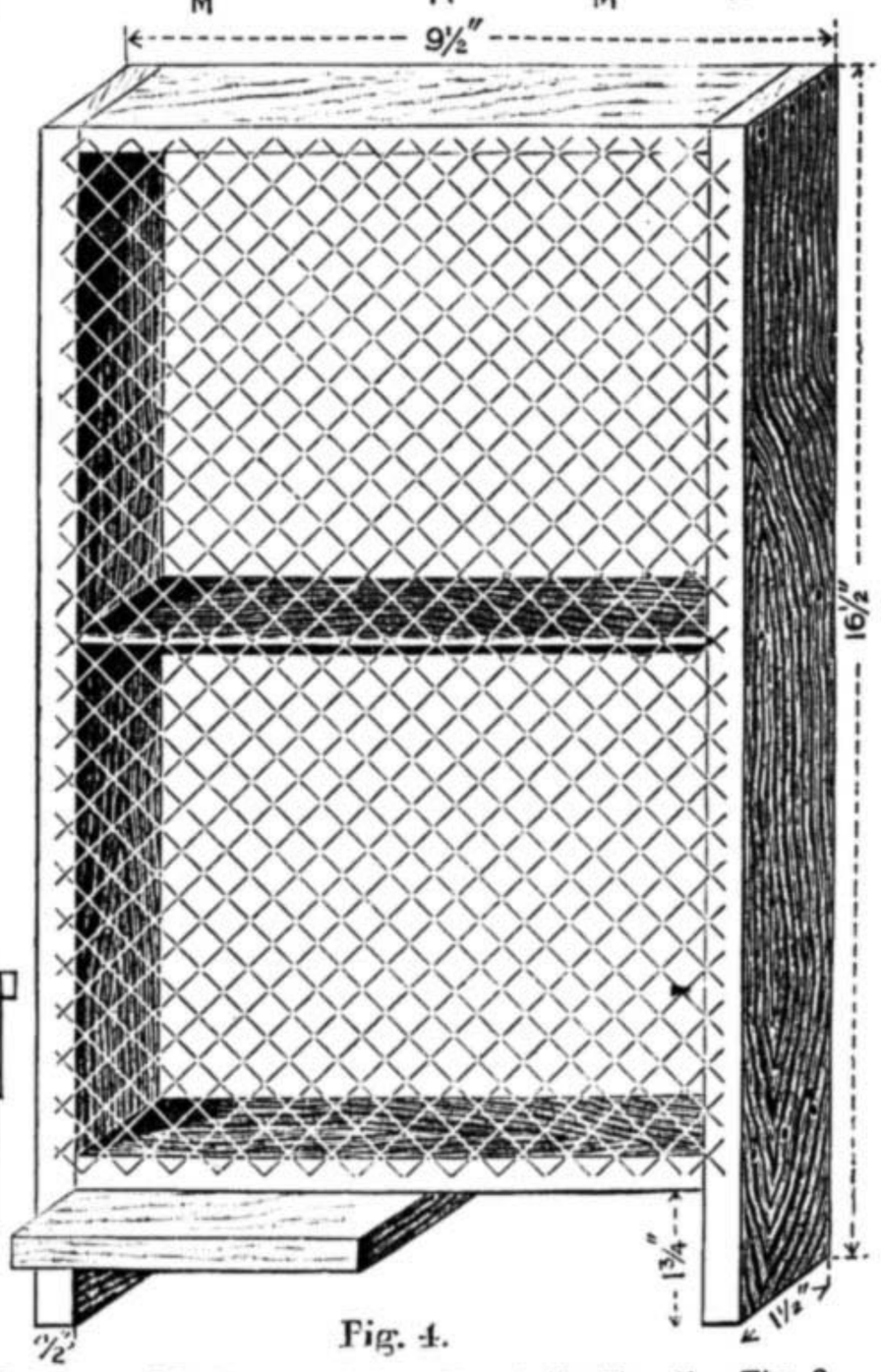

Fig. 4.

It will be noticed that in the connection between the back and top and bottom, I give a plain, soldered joint. A better and harder job would be with a folded joint. If any of my readers wish to try their 'prentice hand at this, another line will be scribed a quarter of an inch outside the outer of the lines in Figs. 2 and 3, and the back will be half an inch longer. When the doubling is done, a quarter of an inch being allowed for each fold, the measurements will be found right. It is scarcely necessary for me to go into minute details of these joints, but I may just say that they are found in any ordinary tin can, the study, and even the dissection, of which I can strongly recommend to any one who starts at sheet metal work, or tinkering, as it is commonly called in the country.

The making of this extractor will not take long, and if my instructions are followed carefully, a really good machine will be the result.

To the five or six shillings saved the amateur may add the inexpressible pleasure of looking proudly on his own handiwork, and feeling in himself the sense of power which difficulties overcome always produces.

Fig. 1.—"Little Wonder" Extractor. Fig. 2.—Pattern of Bottom and Low Front (A, Fig. 1). Fig. 3.—Pattern of Top. Fig. 4.—Wire Netting and Frame. Fig. 5.—Section through Extractor at Upper Strap. A, Netting; B, Space for Comb; C C, Frame; D, Tube; E, Shutter; F, Cleat on Shutter; H H, Strap; G, Handle.

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MODERN FORGING.

BY J. H.

WELDING.

THIS is the method which often becomes the alternative of drawing down or of upsetting. The property of weldability is one of the most valuable that is possessed by wrought iron and mild steel; and to a practised smith the art of welding presents no difficulty at all. The correct heat and due cleanliness are the chief requisites.

What is termed the "welding heat" corresponds with that temperature at which the metal is in a partial state of surface fusion. At that temperature it is extremely plastic, and a little hammering will cause two surfaces to adhere and possess as much strength as the unwelded part of the metal. But the welding heats for iron and steel are very different, and even also the heats for different qualities of iron and different qualities of steel. The better the quality of the iron the higher the welding heat that it will stand without becoming burned; and any iron will require a much greater heat than steel. At a welding heat iron gives off an abundance of dazzling sparks; steel only shows an intense yellow, with little sparking. These colours are a matter for experience entirely, and no description or illustration can take the place of practical lessons. But in the mere mechanical part of the work illustration can give correct ideas as to practice, and to this, therefore, my remarks will chiefly have reference.

Reserving more difficult examples for future articles, I will in this elementary chapter take two plain examples of welding: one shall be a collared rod similar to that which was upset in the last article, and drawn down in the article previous; and the other shall be a plain straight rod.

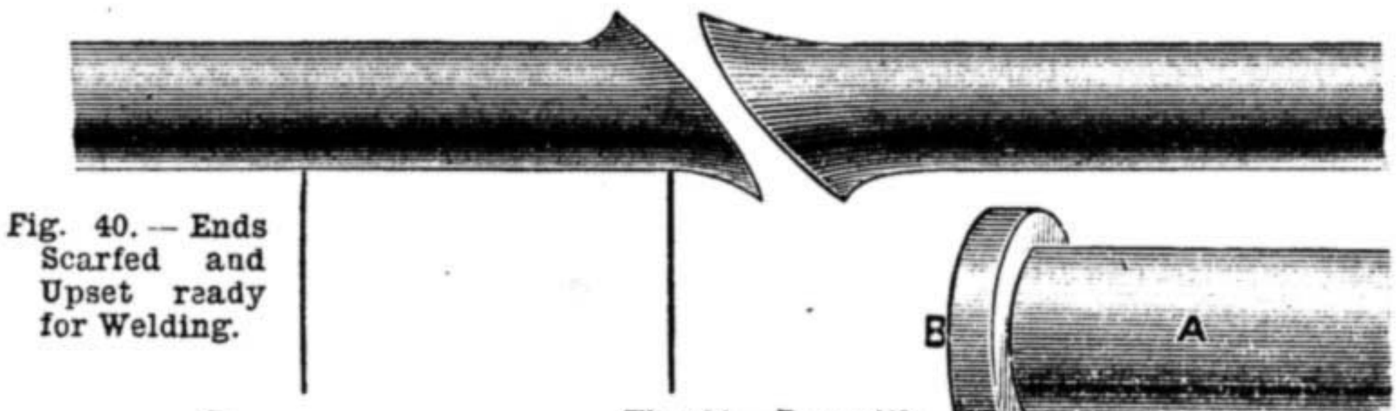

Fig. 40.—Ends Scarfed and Upset ready for Welding.

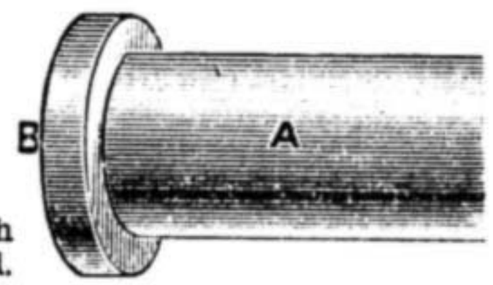

Fig. 34.—Bar with Shouldered End.

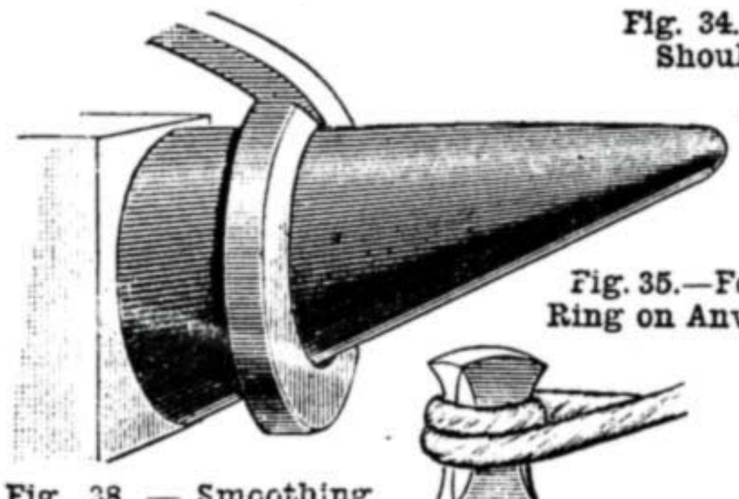

Fig. 35.—Forming Ring on Anvil Beak.

Fig. 38.—Smoothing Faces of Ring with Fuller.

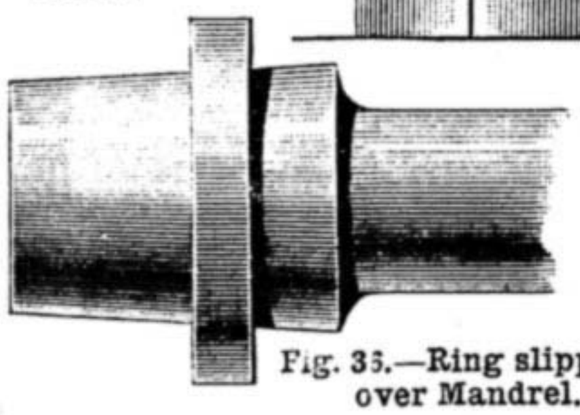

Fig. 36.—Ring slipped over Mandrel.

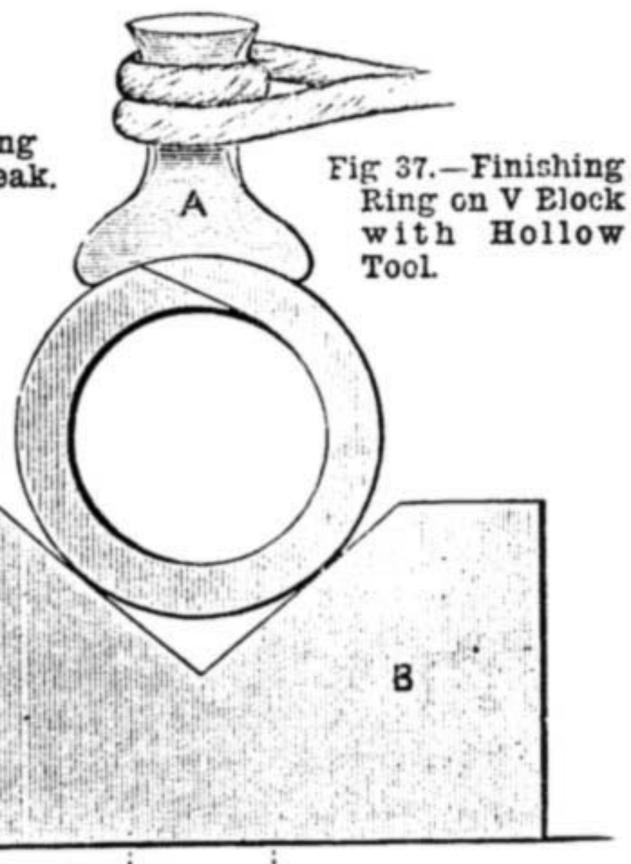

Fig 37.—Finishing Ring on V Block with Hollow Tool.

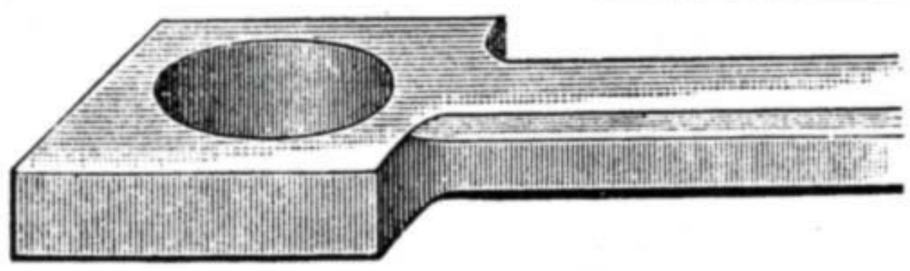

Fig. 39.—Heading Tool.

Taking the shouldered end (Fig. 34), first cut off the rod A, and then prepare the ring B to fit over it. For the ring take a square bar, rather larger, say $\frac{1}{8}$ in. larger than the finished section required, and either cut off one end *diagonally* with a hot set, or else fuller it down. Then turn the bar roughly into the form of a circle over the anvil beak (Fig. 35). Before proceeding farther, the bar will be cut off to the required length, with a sloping face to lap upon and match the first diagonal. The metal must not be skimped, but sufficient lap must be allowed for welding and for neat dressing off and finishing. If the ring is fairly true now, it will be ready to go back into the fire for welding; but if not, it will be further treated as follows: and if there are several pieces all alike it is better to get all the rings turned into neat circles before welding any of them.

Get a mandrel (Fig. 36), and slip the ring over it, and hammer the scarfed joint into a neat appearance, either with the hammer alone or with one of the hollow tools (Fig. 37, A). Then slip it off the ring, and flatten the faces (Fig. 38). This is precisely the plan that would be adopted in welding a separate ring.

To weld the ring to the rod, the ring will be slipped over the end of the rod, care being taken to remove any scale adherent to either, and then put into the clear fire together. Sand may be sprinkled over the work, but with a clear fire it is not necessary, and is frequently not done. At the welding heat, which for wrought iron is of a dazzling whiteness, when the iron seems ready to melt, and particles appear ready to drop off, and a rapid evolution of sparks takes place, the work is removed from the fire, placed on a V block (Fig. 37, B), and the scarf joint and the ring are hammered all round with a hand hammer, the rod with its ring being turned into continually fresh positions on the V block the while. Then, if a hammerman is available, the hollow tool (Fig. 37, A) is taken up, and a few blows upon it consolidate and finish the surfaces. Then the faces and shoulders are finished by means of a heading tool (Fig. 39), having a hole of a size suitable to take the rod, a few blows with hammer and flatter finishing off both the under shouldered face and the upper flat face. Then it may be necessary to work over the circular part again with the hollow tool as a matter of finish. All this is for finish merely, for the welding heat is soon past, and if the union of the joint faces is not fully effected in the first few seconds it will be more or less imperfect. Most of the welding is, in fact, effected by the hand hammer, unless the work is heavy, when it is either done by the sledge or under the steam hammer.

To weld a rod, a scarfed joint is employed. Since plenty of metal is wanted to allow for hammering the joint together and for finishing it afterwards without reducing below correct sizes, the ends of the bar have not only to be scarfed, but to be slightly upset. First, the bars whose meeting ends have been cut off square are laid horizontally upon the anvil, and the ends upset or beaten over, while nearly at a welding heat, with hand hammer, or, if large, with a sledge or with the pendulum monkey shown in page 336, Fig. 33. Then they are laid over the edge of the anvil, and scarfed or beaten down diagonally with a fullering tool, the face being made rounding rather than hollow. Both ends being served precisely alike, they are put back into the fire and raised to the welding heat. By moving the coal aside now and again the smith judges of the proper heat for removal: which must not be too low, or the metal will not weld, nor too great, or it will become burnt. When taking the work from the fire, *lift it vertically out, not drag it through the coal.* If any particles of dirt are present, they will show as dark specks on the white-hot iron. If there is any dirt present brush it off with a bundle of brushwood. The smith and his helper lay the scarfed ends together, as shown in Fig. 40, and then two or three blows with the hand hammer will cause union to take place. The two ends being first united, the bar can then be rapidly turned about on the anvil while the joint is consolidated all round with hand hammers or sledge, and then the top and bottom swages can be used for imparting the finish required. It will be apparent that without the first enlargement or upsetting of the rods, the process of welding and swaging would have immediately reduced the diameter of the rod at the welded section below that of the other portions. How much to upset and how much to scarf are matters for experience. The drawing gives ordinary proportions accurately.

This is an elementary chapter, and descriptions of the various methods by which weld joints are made will be best reserved for the miscellaneous examples of forged work to be embodied in successive chapters.

A NEW USE FOR SPOILT NEGATIVES.

BY ARTHUR BOWES.

IT may be taken as granted that every photographer produces, to a greater or less extent, negatives which are useless. It may be from faulty manipulation or, let us charitably assume, more often from circumstances which are beyond his control. To find a use for these spoilt negatives is a

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problem which is difficult to solve in a satisfactory manner. It is true that the smaller sizes may be used as cover plates for transparencies, and others, when sufficiently large, may be utilised for covering-in greenhouses or ferneries; but there are many amateur photographers who will not care to resort to either of these methods of using up their waste plates, and still are unfortunate enough to find themselves accumulating failures in a very annoying manner. The suggestion that I have to make here, and which is the outcome of my own practice, is to convert these spoilt negatives into plates for etching in the manner detailed below. The process of development reveals whether the negative is a success or a failure; if there be any error of exposure, or if the object should have moved, the evil effects are visible during development and before the fixing of the plate. If it should be found that the negative is spoilt, do not put it on one side just as it is, but expose the whole plate to the action of light, either daylight or artificial; immerse it again in the developer, and you will, naturally, find the plate develop all over to a dense black deposit. All traces of the picture

Imaginary Landscape Etched on Spoilt Negative.

will be obliterated when viewed by transmitted light, though, perhaps, some signs of it may be seen by reflected light on the back of the plate. Give the plate a rinse under the tap, and, when dry, it is ready for etching upon. There is no need to use the fixing bath, as there are no residual silver salts to remove; they have all been acted upon by the light and by the developer.

Obviously, the final results of the etching will vary in artistic merit with the ability of the artist. It must not be expected that every one, however unskilled in draughtsmanship, will be able to produce a pleasing and artistic picture, but for any one with a slight amount of talent in this direction, the process offers very great facilities, and is infinitely less troublesome than etching in copper, both in the method of etching and in the after production of prints. All the tools that are necessary are two or three needles set in handles, and a penknife. There is no "biting in" with acids, and the prints are to be produced on bromide paper, just as from an ordinary photographic negative. The needles should be stout, strong ones, broken short and set into wooden penholders so as to project about a quarter of an inch. They must be quite rigid and have no spring. Before commencing, sketch on the film with a lead pencil the outlines of the picture, so as to serve as a guide, then with a needle point scratch firmly on the film, and a fine, clear line will be produced going quite through the film, and leaving the glass underneath exposed. If the needle be held rigidly, it will be found that a free, decisive stroke can be given, and all the details of foliage, etc., can be drawn with quite as much character as they can be with pen and ink. For drawing long parallel lines a rule can be used to guide the needle point. The penknife blade is useful for removing large portions of the film, and for putting in strong, thick lines. It must be remembered that where the film is removed a perfect black will be obtained in the final print, and where the film is left untouched pure white will be the result. The intermediate tints are to be arrived at by the use of lines, broad or fine, wide apart or close together, exactly as in pen and ink drawing.

As to the style of drawing to be adopted, it is little use offering any advice, for every effect can be obtained, from the most minute and finished etching to the broadest and boldest sketch. Perhaps the easiest effects are to be got by the bold, strong-lined treatment which is to be seen in the etchings of John Constable, Geddes, or Wilkie. It is when the plate is finished, or approximately finished, that the advantage of the process over copperplate etching makes itself felt, for both in taking proof prints and in adding to or rectifying effects on the plate the operations are of the simplest description. Instead of pulling off a "proof" with printers' ink, a piece of bromide paper is exposed behind the plate, developed and fixed in the usual way. Additional touches can then be made on the negative where required, while any part of the picture that it is desirable to remove may be simply blocked out on the plate with thick Indian ink and a fine brush. A dozen prints in pure black and white can be turned out in an hour or an hour and a half, and they are as permanent as if executed in printers' ink. In printing from the copper plate, the method of "overlaying," or putting extra thicknesses of paper over certain parts, is adopted where it is desirable that the impression shall be strengthened. In the photographic process, the same effect is obtained in a much easier way by shading parts of the negative from the light during exposure, and exposing for a longer time those parts which it is necessary to print darker than they would otherwise appear.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Casting in Plaster.

Repairing Injuries done in Casting—Plaster Spatulas—Toned and Coloured Casts—Moulding High Reliefs—Casting Medallions—Working in the Mould—Moulding from the Round—Precautions against Discolorations in Casts.

In the last chapter I gave a tolerably comprehensive account of ordinary waste-moulding, and it is by waste-moulding that a clay model is always transferred to plaster. It is, therefore, to those concerned with sculpture, by far the most important part of casting. Many matters connected with it still remain to be spoken of; but before I have done, I shall have something to say about piece-moulding and other processes for the multiplication of casts.

The relief of Apollo which we saw freed from its mould was presumed to have been cast successfully. Yet even the most successful cast will rarely be altogether free from injuries or defects. A projecting bit or two may have been chipped off; the chisel, slipping through the inner mould, may have made an indentation; or an air-hole may have shown itself. Accidents such as these, if of any considerable size, are best repaired at once. A piece broken off is most quickly replaced with a little shellac dissolved in spirit—or, more neatly, with thin liquid plaster. Liquid plaster is also mixed for stopping holes; but for this latter purpose it needs to be "killed"—that is to say, it must be allowed almost to set, and must then be beaten up with a little more water; without this precaution it would set harder than the surrounding parts, and be of a slightly different colour.

For these operations steel spatulas are used. Figs. 20, 21, and 22, are examples of plaster spatulas, drawn, like all other tools shown in these articles, to half-size. Fig. 23 gives a spatula combined with a scraper—a kind of tool of which more must be said when I come to speak of working on plaster.

In the case of the Apollo we were content to leave the cast perfectly white; but some think the natural plaster cold and raw, and a warmer tint more artistic. The tone most liked is that produced by a mere suspicion of yellow ochre. Should this be given, the colour must be added in the same manner as in tinting the mould—that is to say, in the water with which the plaster is mixed. The powdered ochre must be put in, well stirred, any scum which may rise skimmed off, and the coloured water poured into another vessel for use. Care must be taken, in doing this, not to disturb or to pour too near the sediment at the bottom, since, should any of this get into the plaster, the cast will be disfigured with yellow specks. Some persons tint busts and statuettes with such colour as will give them the appearance of terra-cotta; and sometimes a moulding, or ornamental corners are added to a relief, differing in colour from the relief itself, Prussian blue being sometimes used for these purposes. Indeed, there are various ways in which colour may be made useful in plaster work; but in every case it should be mixed in the above manner, and enough water tinged at once for the whole operation, as it is difficult to bring a second mixing to exactly the same shade as the first.

The moulding of high reliefs may be a little more trouble than such works as the Apollo, and some little time and patience are often required in removing the clay from the mould upon those parts which are prominent and much undercut; and when limbs and heads are quite isolated from the background, the easiest, and often the only practicable, way of dealing with them is to cut them off with a wire, to mould them separately, and to fix them in place again after casting.

When speaking of modelling medallions, I mentioned the facility with which a correct circle at a proper distance round the head, as ground for a medallion, might be struck in the mould. In casting a medallion on such a slab as I described, there is no necessity for continuing the mould over the edges of the slab—it is enough to cast a sufficient extent of the flat face. When the mould so cast has been washed, it is easy to lay a bit of flat wood across the hollow which represents the head, to take the compasses, and by making a trial or two, without touching the plaster, to ascertain where upon the wood will be the centre of that circle which will leave

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an effective space all round the head. It will probably be found somewhere just in front of the middle of the ear, or rather, on the projection which lies over that point. A good deep circle can then be cut in the plaster with the travelling leg of the compasses. In filling the mould, the plaster must extend a little beyond this line, which will show plainly as a ridge on the cast after chipping out, and to it the ground can readily be pared with a knife in the moist plaster.

This is one thing most advantageously done in the mould; but there are others. Levelling the ground is one of these. When a relief has been long on hand, the background is apt to become somewhat battered; it will get indentations from tools and fingers which it would be a work of time to fill up with clay, and to smooth down with accuracy; but if allowed to remain, these unsightly hollows, which will appear in the mould as elevations, may then be scraped down to a perfect level with a few strokes of the drag.

Another is in the case of raised letters, etc. To model an inscription of any kind in raised letters is a work of considerable labour, but to sink them—reversed of course

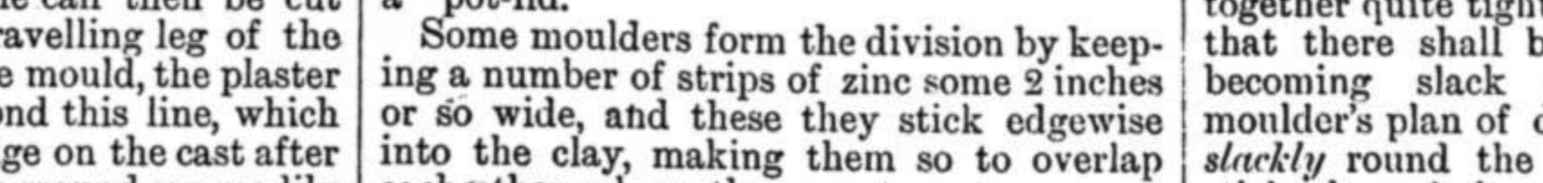

Fig. 20.—Plaster Spatula

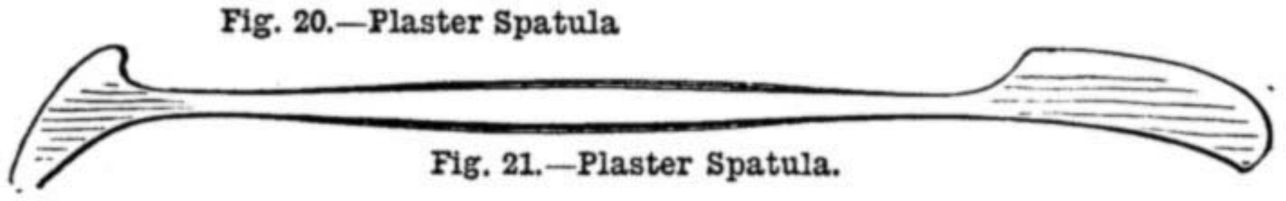

Fig. 21.—Plaster Spatula.

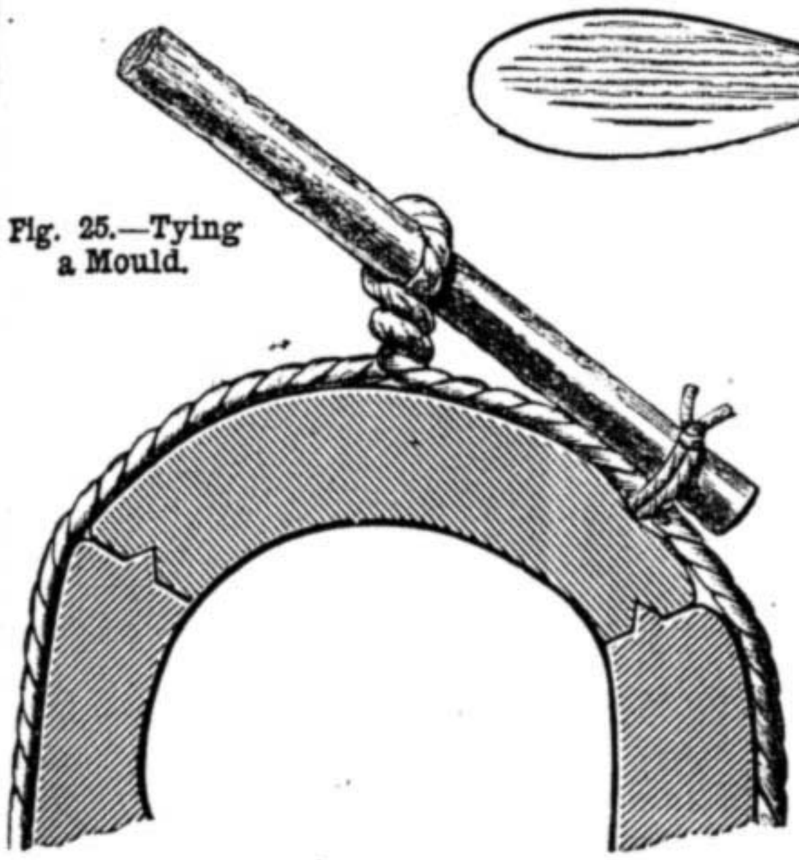

Fig. 25.—Tying a Mould.

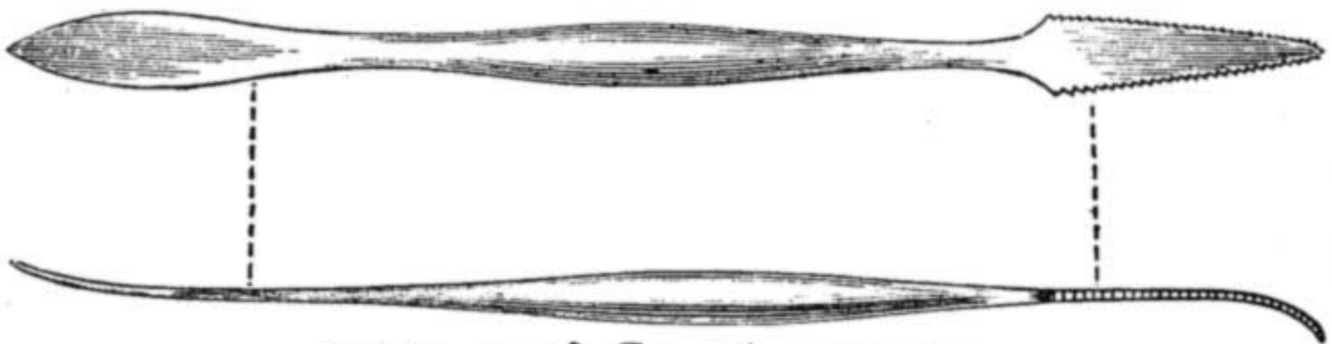

Fig. 23.—Combined Spatula and Scraper.

Fig. 22.—Plaster Spatula.

Fig. 24.—Edge of Mould with Key-holes.

—in the mould is quickly done, and the result in the cast is the same. It may be as well to say here that any simple flat ornament is often most readily worked in the same manner.

The moulding of a relief is a simple matter because (with the trifling exceptions mentioned) it can be done in one piece; but works in the round give more trouble, because from them the moulds have to be made in two or more pieces. Our modeller has, we will say, a life-sized bust ready; let us see how he will set about casting it.

There are two ways in which he may divide his mould. He may either part it into two nearly equal halves, front and back, by a line up the ridge of the shoulder, over the ears, and across the top of the head; or he may make a "pot-lid"—that is, a circular piece may be enclosed on the back part of the top of the head some 4 or 5 inches in diameter—such of that portion of the head, in fact, which in representations of Saints is marked out by the nimbus—whilst all else is moulded in a single piece. Special circumstances may render one or the other arrangement desirable, but it will be seen that the second is in a general way the best. After casting, the line of division is sure to show itself, and more or less labour will be needed to obliterate it. The first plan gives us a long line, and one running over parts that catch the eye; whilst the second gives but a short line, and that wholly upon the hair, where it is scarcely seen. We will suppose therefore that our moulder makes a "pot-lid."

Some moulders form the division by keeping a number of strips of zinc some 2 inches or so wide, and these they stick edgewise into the clay, making them so to overlap each other where they meet as to prevent the plaster from running between. Others make strips of clay about ¼ inch thick and 1½ inches wide, and attach these edgewise to the model along the line of parting, blending them together at their ends so as to form a perfect wall. To prevent their being displaced by the weight of plaster to be thrown against them they stick wire skewers into the model, at intervals, behind them. The metal parting is the least trouble, but it makes a more unsightly seam than the strips of clay.

This wall built, the first portion of the mould (which will, in our present case, be the "pot-lid") is made in the usual way with its inner coloured, and its outer uncoloured, divisions. The slips of metal or clay—whichever are used—are then removed, and any ragged edges which might interfere with an easy separation cleaned carefully away. Along the edge of the mould our moulder then bores a series of funnel-shaped holes with the point of his spatula or scraper, as shown in Fig. 24. That done, he brushes clay-water over the edge, holes and all.

After the remainder of the mould has been cast, it is not difficult to insert a chisel into the line of partition, and to induce the two portions of the mould to separate. The clay-water has effectually prevented them from uniting. A slight chink having been opened, water can be poured in, and the piece of mould worked by the hand as before described—persuasion being, as was before remarked, better than force. In the present instance our moulder has only to raise his "pot-lid," which, owing to its small size, is easily done. Yet the opening made is sufficient to allow the clay of the head to be removed through it. The cross-arm of the wooden frame can then be pulled from its mortise, and that done, the frame generally can be drawn out from the bottom of the mould. The removal of the clay of shoulders and neck is now an easy matter.

After cleaning, no difficulty is found in fitting the two pieces of mould together with absolute precision. This is ensured by the "key" holes bored in the edges of the first piece, for corresponding conical lumps have, of course, been formed on the edges of the second piece, and no inaccuracy is possible. Before they are filled, it is necessary that the two pieces should be bound together quite tightly, and in such a manner that there shall be no chance of the tie becoming slack during casting. Our moulder's plan of doing this is to tie a cord *slackly* round the two pieces, to thrust a stick through it, and by turning this stick to twist the cord till absolutely tight. He then secures his stick by tying one end to the cord with a piece of twine. Fig. 25 explains his plan. He puts two or more of these ties, as may be required, and generally contrives to slip his cord under one of the irons of the mould to prevent it from slipping.

In filling this, or any other mould, from the round, a less thickness of plaster than was needed in our relief of Apollo will suffice, anything approaching the cylindrical and spherical form being in its nature stronger than a flat one; but the weak part of our bust—that is, the neck—will need to be strengthened. Wood swells and shrinks too much to be good for the purpose, and iron, though too frequently used by professional moulders, in figures as well as busts, is to be avoided, since by rusting it discolours and in time destroys the adjacent plaster. Copper, though more costly, has no such fault, but for our present purpose a sawn slip of slate answers admirably, and is inexpensive. Our relief of Apollo was too small to require strengthening, but for larger reliefs these slate slips are excellent. For statuettes and small figures copper wire of appropriate size is the best thing to strengthen limbs, etc. The slate, copper, or whatever else is used for strengthening, should not be laid on till the facing of the cast is pretty well set, and it then becomes embedded in the backing.

The moulding of statuettes and larger figures in the round is essentially the same as moulding busts, only that the moulder has to use his judgment more in laying out his divisions.

Though fine plaster looks so daintily white when newly cast, a yellow discoloration—owing, doubtless, to the presence of sulphur—sometimes appears as it gets dry. This colour seems to be carried to the surface by the moisture, as the latter is drawn out and evaporated; and by placing the cast with its *back* to the fire, the face may be kept unsoiled. This is an important point to remember as regards medallions, small reliefs, etc. In busts and large matters which are to be painted, the discoloration does not so greatly matter.

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A LADY'S COMBINED TOILETTE AND WRITING TABLE.

BY JAMES SCOTT.

To an exceedingly large proportion of my readers the ideas embodied in my present design may not be welcomed, on account of the article being intended for the ladies' use. It may, however, happen that I am mistaken in my conjectures, and it is for this latter reason that I give the design this week. But if there should be any among the number who feel inclined to verify my surmises, I would ask them to fully consider the matter before finally deciding, as there are, no doubt, very few who have not one or more female friends or relatives to whom an article similar to the present design, either as a present or by sale, would be very acceptable.

Probably it will be urged by some that, if for a present, too much material and labour will be required to be spent upon it; and that, if for sale, the same reason will hold good, on account of the ladies' funds. To these imaginary grumbles I will reply by saying what, perhaps, I might leave unsaid—that it is far easier, in a great many cases, to curtail a design than to add to it, and that, therefore, it will only be necessary to leave out any part which may be considered superfluous or unnecessary; although I think that, if the design is carried out as shown, a more appropriate and useful article would be made than if altered. Being a combination for purposes of toilet and writing, even if more elaboration is bestowed upon it, the expense and labour incurred will not reach the amount necessary if a toilet and writing table be made as two separate articles.

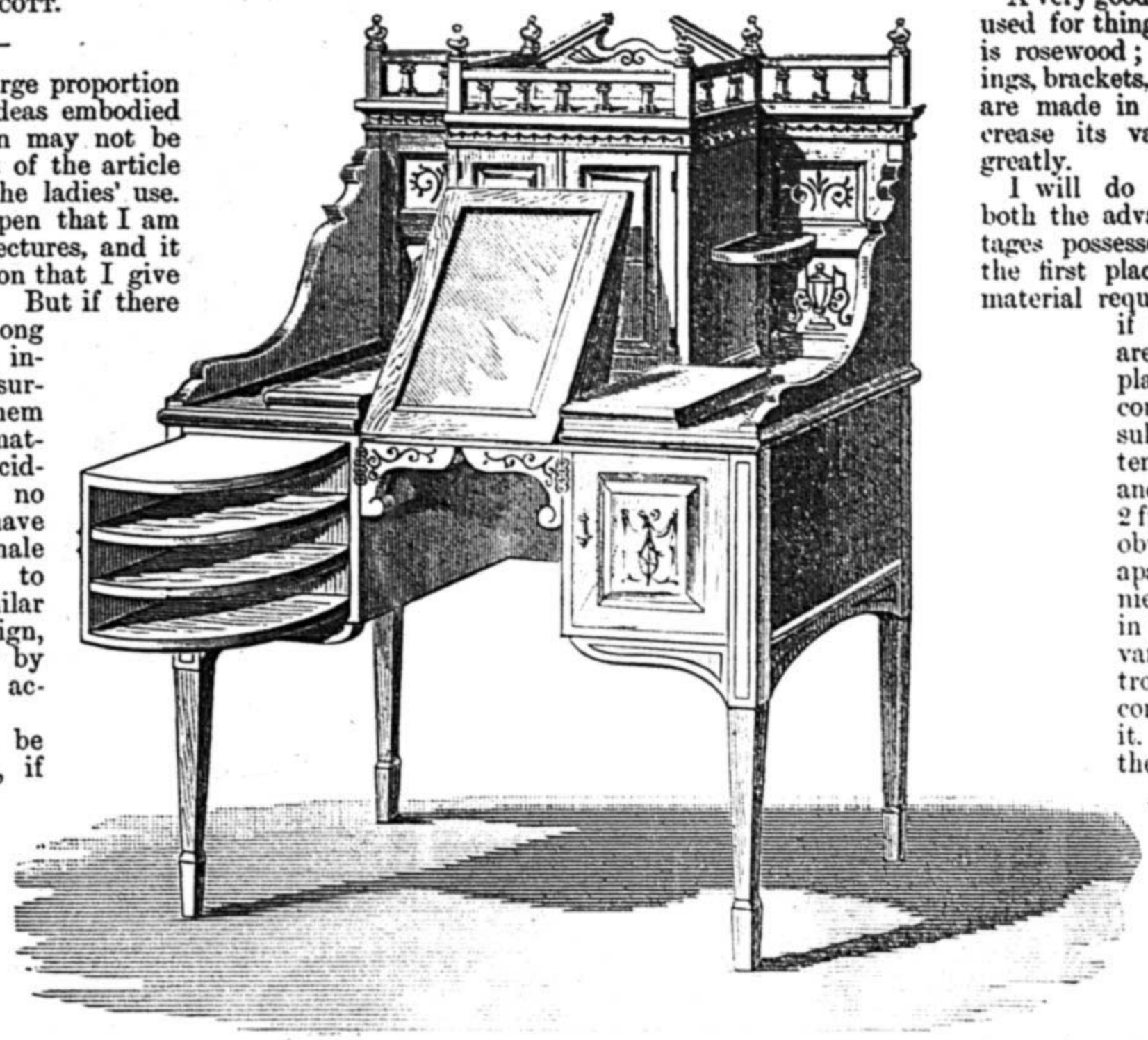

Fig. 3.—Table represented as Toilette Table.

Fig. 2.—Table represented as Writing Table.

Fig. 1.—Table shown completely closed.

A very good wood, and that mostly used for things made for the ladies, is rosewood; and if panels, mouldings, brackets, shelves, and pediment are made in satinwood, it will increase its value and appearance greatly.

I will do my best to set forth both the advantages and disadvantages possessed by this table. In the first place, as before said, the material required will be less than if two separate articles are made. In the next place, space has been considered, with the result that this table is intended to occupy in length and width, when closed, 2 ft. 6 in. by 15 in. It is obvious that a very small apartment will conveniently accommodate it in this size. Another advantage is the very little trouble necessary to accomplish the changes in it. It may chance that the particular lady who is using it tries to economise time in the same manner that the table economises space, by writing a few letters while she is curling her hair, or during some other performance of the toilette; and, in my own little experience, I am perfectly aware that the ladies—especially the young ones—consider hair curling a very delicate operation, and are frequently

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heating—I had almost left out the "h" in this word—their curling tongs, thus having a few odd spare moments, which might be utilised in the manner I have suggested.

I have spoken of a few of its advantages, now I must mention its drawbacks, but they are not so numerous as to outweigh the advantages. Firstly, no article could be conveniently placed upon the front part of the table top, on account of the square flaps having to be opened; but as there is plenty of room elsewhere for such articles, if the table top is nicely inlaid, *that* will be a better ornament than anything made in either china or glass. Secondly, another drawback is, that, when used as a toilette table, as in Fig. 3, anything that is within the top cupboard cannot be conveniently abstracted from it, but as there is plenty of room elsewhere, this drawback should not be considered of much importance.

opposite directions, thus permitting the glass, etc., frame to be adjusted, as in Fig. 3.

The construction of the brackets must be particularly noted. They will be made as shown in Fig. 5, in which diagram I have given one of them in two positions, in order to convey a better understanding of them. To the back of each curved piece, and close up with the edge, is fitted a triangular piece, the back edge of which will fit nicely against the bottom part, between the glass frame and the writing flap. If the brackets are fitted by means of hinges (ornamental ones should be used) fitted *outside*, it will be found that, when they are fully opened, nothing will impede the free movement of the glass, etc., frame. They will also support the frame as desk, and, although the latter overhangs, as it were, the weight of the article behind will be sufficient to keep it steady.

the stationery box is raised, the lower half of the inkpot case being heavier than the upper half, if the pivots work freely, the case will always remain in the same position; as, of course, it will be observed that, if it were stationary, when the stationery box was raised the case would lie upon its side, and the ink contained in the bottles within it would part company with it.

Fig. 6 conveys an idea of this inkpot case, and also the most convenient way in which the compartments for envelopes and note-paper might be made. The complete box is hinged or pivoted at its right angular corner to the bottom board of the right-hand cupboard.

The revolving shutter is not absolutely necessary, as, when the box is closed, the stationery within it will lay horizontally; but should the box be closed with a sudden jerk, the contents will shoot out, so that the

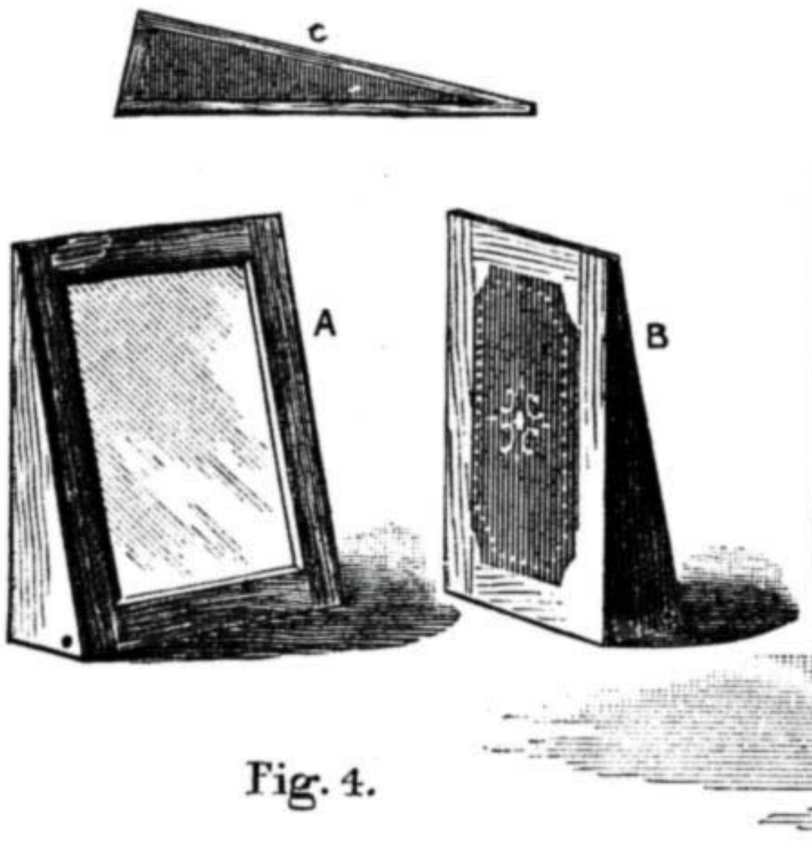
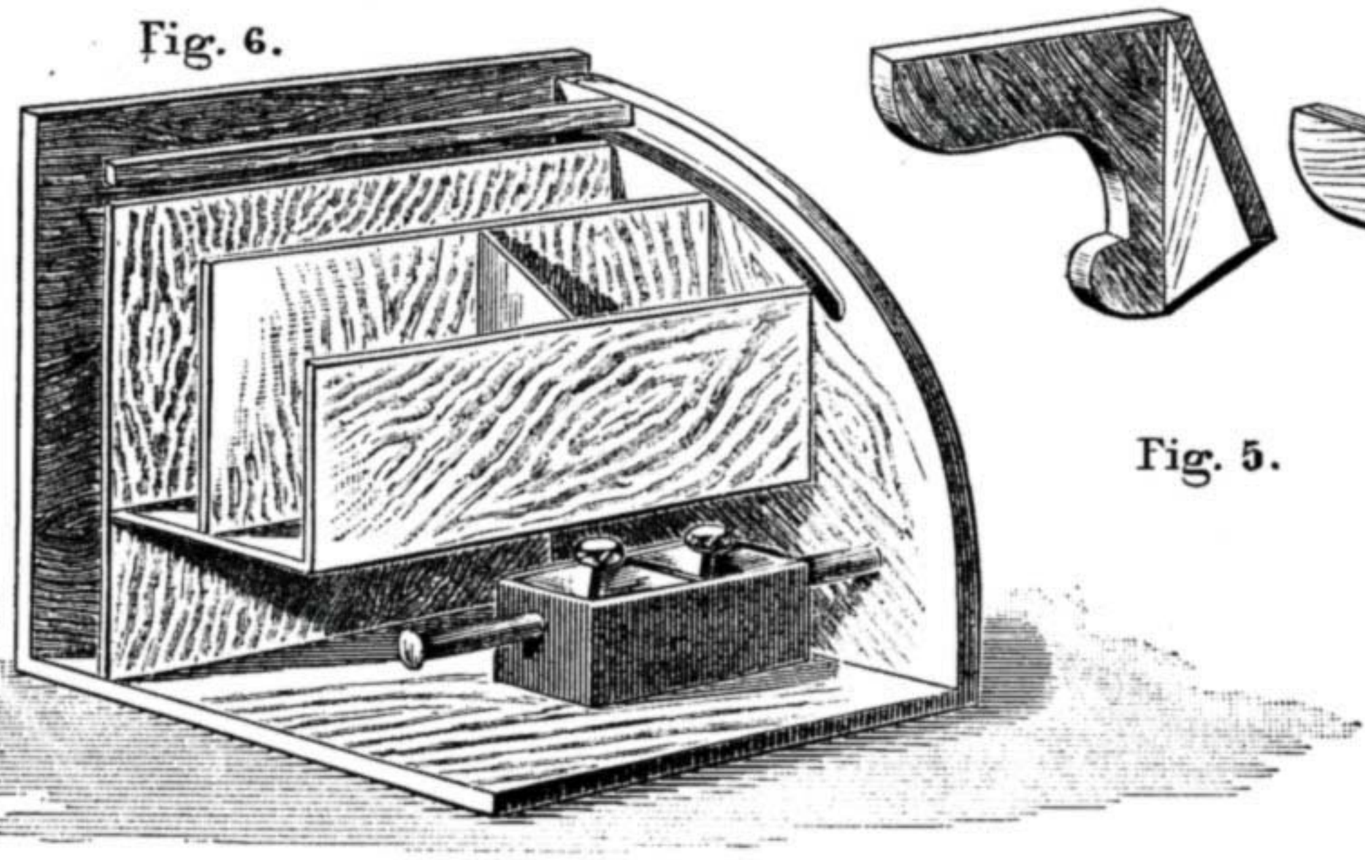


Fig. 4.

Fig. 6.



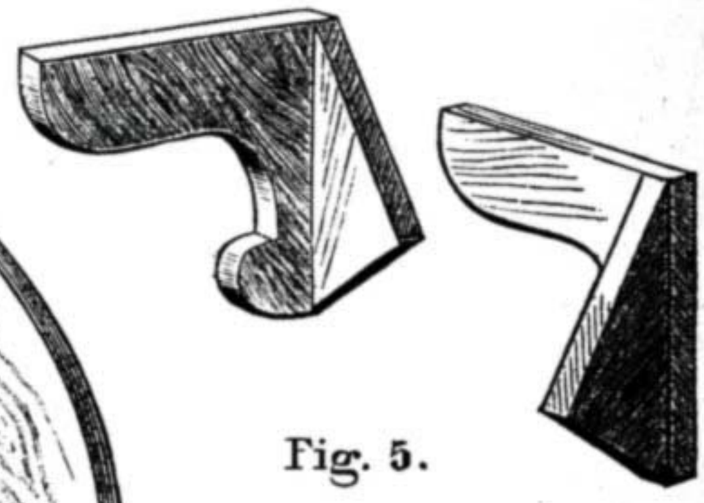


Fig. 5.

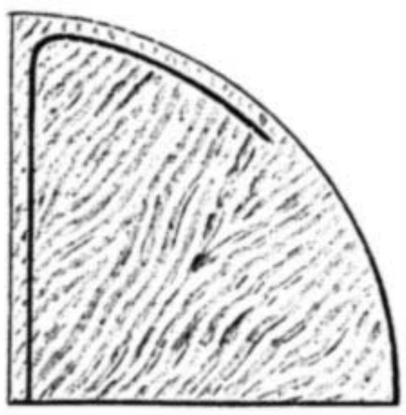


Fig. 7.

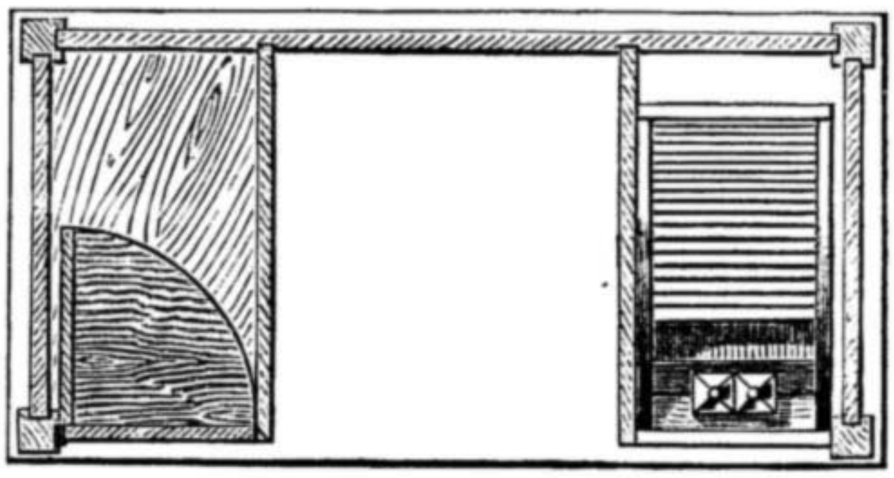


Fig. 9.

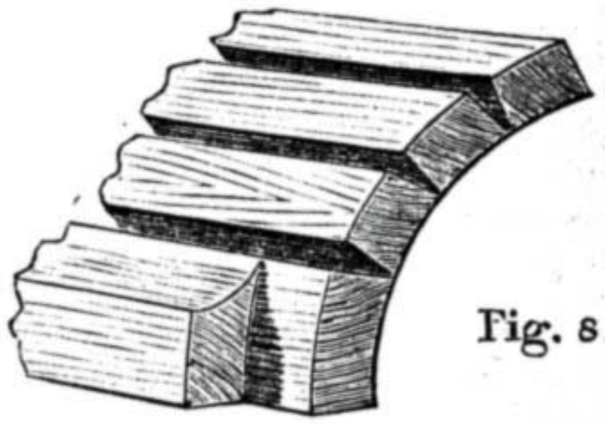


Fig. 8.

Fig. 4.—Diagram showing Desk and Glass Frame—A, Looking Glass Side; B, Desk Side; C, Section. Fig. 5.—Two Views of Bracket to support Desk and Glass Frame. Fig. 6.—Inside of Right-hand Lower Cupboard as Stationery Box with Revolving Inkpot Case. Fig. 7.—Side of Stationery Box, the Black Line indicating how Groove should be cut to receive Revolving Shutter. Fig. 8.—Bottom Lath. Fig. 9.—Plan of Lower Carcase.

In Fig. 1 the table is shown closed. The main feature of the article is here almost concealed. It consists of a glass frame joined immediately at one end to a writing flap, and at the other end to it by means of a narrow board, two triangular pieces being fitted at the sides, in order to give strength to it. This combined glass frame and writing flap is pivoted at the corners indicated by dots in Fig. 4 (A, B, C) between the two lower cupboards, in such a manner that it will revolve and fit exactly underneath, and in contact with, the top board. Along the edge nearest the pivots must be fastened a narrow strip of wood. The brackets (concerning which I shall say more lower down) cannot come close up against the edge of the glass frame unless the latter is pivoted to the thickness of the top board, in which case it will appear unsightly, as part of the glass will always be exposed, whereas I have intended it to be hidden by two small square flaps, which should be hinged to fold in

When the glass and desk frame is underneath the table top, it is apparent that the heavy weight of it will need a strong support, and for this reason, if the brackets are made as shown, the pressure of the glass frame will be resisted somewhat. Numerous methods could be adopted to prevent the brackets flying open, one being by means of an ornamental hook on the front connecting them at the top corners, which come together; or by having a plain hook, answering the same purpose, at the back of the brackets.

The bottom compartments must now be dealt with. The right-hand one (being the most convenient for the purpose) consists of a stationery box, with inkpot case, and revolving shutter. The first is accomplished by making a small box with a partition across the middle, and pivoting it to the sides of the compartment. The pivots must be *above* the centre in each side of the inkpot case, the reason for this being that, when

use of the shutter will be found to be the best course to adopt. The end of it need not come below the front of the stationery compartments, as shown in Fig. 6. To make this shutter, glue a sufficient number of laths or narrow strips to a piece of canvas, then cut a groove along the inside of each sideboard along the line indicated in Fig. 7. The bottom lath should be something like that shown in Fig. 8, the shape of it preventing the shutter being pushed too far, if a narrow rail is fastened at a little distance above the edge of the back partition in the stationery box, as in Fig. 6.

The left-hand cupboard is intended to open in a different manner to the right-hand one, being hinged to the leg block; but I have placed the handle in the same place for the sake of appearance. The bottles and pots of various preparations that a lady considers necessary for toilette purposes are generally very small, so that I think if this cupboard is fitted with shelves, as per

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drawing, it will be as useful as in any other shape.

The top cupboard will be found useful, so also will the small corner shelves. The side brackets will serve a useful as well as an ornamental purpose, inasmuch that they will prevent any article on the top of the table being pushed off.

The pediment and spindle-rail, if made as I represent them, will look better, I think, than if a pediment is fitted right along the top. The back may be panelled or glazed. In the latter case, the light will be reflected, and perhaps, as a writing table, it will be found best fitted so; but as the desk projects beyond the front edge of the table, if inlaid panels are used, very little shadow will interfere with it.

Small brackets fitted under the lower cupboards will add an effect to the table. The brackets under the centre of the table must be so made that the top of each will fit against the edge of the narrow strip on the glass frame.

I will now give some sizes as a foundation to work upon, although, as I have so often remarked, this is so much a matter of individual choice that it almost seems as if space were being wasted by giving them; but as I am aware that such details are welcomed by a number of readers, I ask no further excuse for proceeding with them. Well, then, briefly treated, the following measurements are suitable, but it must be borne in mind that allowance must be made in them for joinery. Table top, a trifle over 2 ft. 6 in. by 15 in., and about $\frac{3}{4}$ in. thick; lower carcase backboard, 2 ft. 6 in. by 12½ in., and about ½ in. thick; four boards forming the lower cupboard sides, each 15 in. by 12½ in.; bottom boards of cupboards each 15 in. by 8 in.; top boards of cupboards each 15 in. by 8 in.; doors each 11½ in. by 8 in., and ¼ in. thick; top backboard 2 ft. 6 in. by 15 in., and about ¾ in. thick, surmounted by mouldings, pediment, and spindle-rails, and panelled with ⅜ in. or ½ in. stuff inlaid; cupboard bottom board a trifle over 15 in. by 9 in.; cupboard top the same size; cupboard sides 15 in. by 9 in. One or two shelves might conveniently be fitted within this cupboard. The doors would look well in clear glass. The total depth of the cornice and frieze should not be more than 2½ in. or 2¾ in., and the whole should be made to fit nicely over the top of the cupboard and backboard in one piece, being filled in by a board to answer the purpose of a shelf on top of the cupboard. I have given my measurements (where not otherwise stated) as intended for wood ½ in. thick, but if thought preferable to have thicker stuff, they can easily be altered.

The glass frame will be 13½ in. by 12 in.; the writing flap 13 in. by 12 in., both joined together, as previously stated, the back piece being 4 in. wide. Do not have a bevel to the glass nor a moulding to project, unless the frame is pivoted deeper down than I advise, as, if used, the two square flaps in the table top will not lay flat.

The bottom board of the stationery box must be a little longer than the door (which latter may be panelled or solid), and the sides should each be a quarter of a circle in shape. If the top board in the cupboard be cut thinner at about ⅛ in. or so distance from the front edge for about an inch, the projecting end of the stationery box bottom board will catch against it, and prevent the box coming right out in front. Of course, there are other ways of effecting this result, but this method is as simple as any.

The backboard of the left-hand cupboard will also be the same size as the front, and the top and bottom boards of it, and also the shelves, will likewise each be a quarter of a circle in shape.

The height of the table from the floor to the large top board will be about 28 in.

Square legs, I think, will look much better than turned ones, and can be fitted with castors, if desired; but in this latter case, when the table is used as a writing table, it will be rather unsteady.

In Fig. 6 I show a small division in the front opening, thus making it into two compartments. Now, as the width of the box will only be 7½ in., according to my measurements, these spaces will be found too small for some purposes; but if the sizes are enlarged, the treatment of the box as in Fig. 6 would be the best course.

For those who require an insight into details of joinery sufficient to enable them to accomplish the completion of one of these tables, I should advise the careful study of such articles as "Some Lessons from an Old Bureau," "A Small Sideboard," etc., in past numbers.

Of course, the sizes that I give may not be quite to the taste of a number of readers, and there may be others who would follow them blindly. To the former I would say, alter them accordingly; to the latter, pin up a large sheet of white paper against a wall and mark on it the heights, etc., that I give, then on another sheet draw a plan according to my measurements, and by so doing a fair idea of the proportions will be conveyed.

Even if the article were made smaller—say, 2 ft. by 12 in.—a useful table would be the result; but this, and also the suggestions of any improvements, I will leave to the reader, bidding him not to be entirely selfish, and make everything for his own use, but to remember the pleasure to be given by the presentation to a female friend or relative of an article of use and ornament—not particularly one exactly according to this design, but of any kind.

OUR GUIDE TO GOOD THINGS.

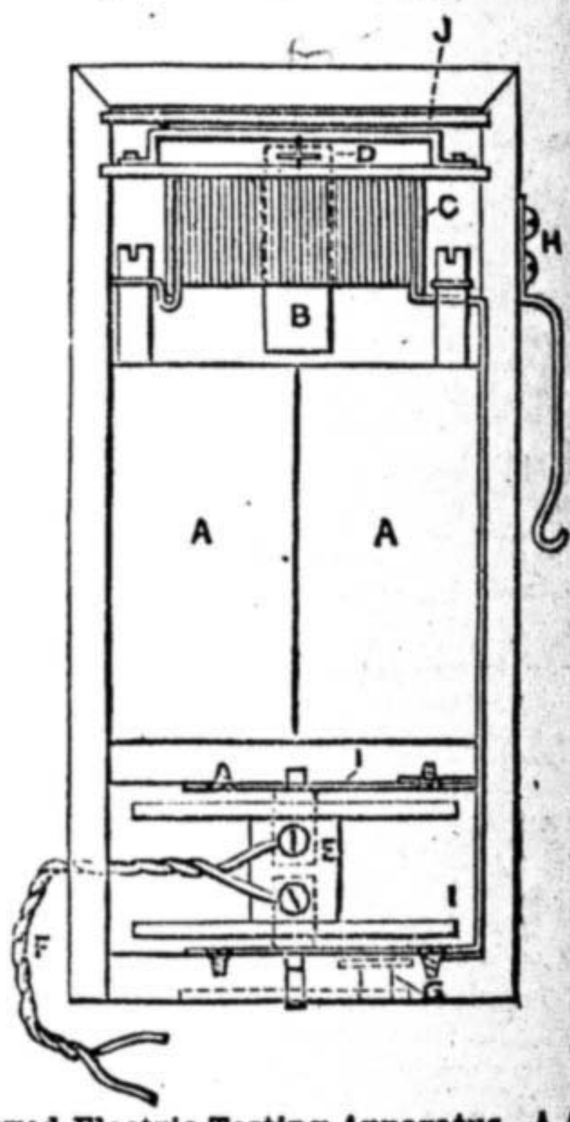
*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

63.—Polytechnic Series Technical Scales.

Every draughtsman and every workman who is accustomed to make drawings to scale, knows how much nicety and exactness are required in the construction of proportional scales, and the time that is taken up in preparing them. It is true that scales are given on the flat boxwood or ivory rule that is to be found in most cases of mathematical instruments; but these, to use a common expression of the time, "are not in it" when compared with the Polytechnic Series Technical Scales which have been prepared by Mr. C. F. Mitchell, and which are published and supplied by Messrs. Cassell & Company, Limited, La Belle Sauvage, Ludgate Hill, E.C., at the nominal price of 1s. per set. The set before me contains eleven strips of card, and on each card, except I, are two scales, the surface of every card being coated with a clear white varnish. The cards are distinguished by letters which run from A to J. Card I contains four scales. Thus there are twenty-two scales to show feet and inches, and two to show mètres and mètre scale ¼ size. Card A contains scales of 12 in. to the foot or full size, and 6 in. to the foot or half full size; Card B contains scales ⅛ and ¼ full size; Card C, ⅛ and ¼ full size; Card D, ⅛ and $\frac{1}{10}$ full size; Card E, $\frac{1}{96}$ and $\frac{1}{48}$ full size; Card F, $\frac{1}{24}$ and $\frac{1}{12}$ full size; Card G, $\frac{1}{16}$ and $\frac{1}{32}$ full size; Card H, $\frac{1}{48}$ and $\frac{1}{96}$ full size; and Card I, $\frac{1}{36}$, $\frac{1}{72}$, $\frac{1}{60}$, and $\frac{1}{120}$ full size. Card J contains mètre measure and mètre scale ¼ size. It is not possible to conceive, or to procure, a more welcome addition to the appliances usually found on the draughtsman's desk than this capital and correct set of scales. Every workman who uses his pencil should have a set.

64.—Improved Electric Testing Apparatus—Provisional Patent, No. 882.

This instrument is designed for use by electric contractors for testing fittings and for general installation work in place of the ordinary detector galvanometer. It consists of a mahogany or walnut case, the dimensions of which are 5½ × 2¾ × 2¾ in., divided into two compartments, the upper containing a small galvanometer (the needle of which is controlled by a small magnet) and a battery. The lower compartment contains



Improved Electric Testing Apparatus—A A, Battery; B, Magnet; C, Coils; D, Needle; E, Spool; F, Testing Cords; G, Winder; H, Suspending Hook; I, Contacts; J, Glass Cover.

a spool and winding arrangement to which the testing cords are fixed. A hook is fixed on to the back of the instrument, by which it can be attached to the body of the workman.

The chief advantages of this instrument are that by means of the hook the instrument can be firmly fixed to the body of the workman, thus leaving the hands free for testing, ascending ladders, etc., and by permanently fixing the testing cords to the spool they can be drawn up into the case, and thus are not liable to get lost or broken, and are always ready for use.

65.—Proctor's Slate Composition.

Messrs. John Proctor and Co., St. Ann's Ink Works, Nottingham, makers of the "Defiance" Writing Inks, send a small sample board covered with their slate composition for putting a good surface on boards intended for use in the school-room, class-room, or lecture-room. It has an excellent effect, and from the appearance and handling, seems never likely to wear bright or glossy, so that anything written or drawn on it can be readily seen in any position. Boards 4 ft. by 3 ft., coated with this desirable preparation, are supplied at 16s. each. The composition is supplied for use at home, etc., at 1s. 6d. per lb. Care should be taken not to mark any board thus prepared with lead pencil. The Editor.

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SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular Saw Teeth.—A. R. (*Scorrier*) writes:—"I have read from time to time papers in reference to the working of circular saws, etc., by makers and others. Now a man may be able to make a good saw, and give a lot of information in reference to working it, and after all fail to give the information that can be given by a man that has had experience in working and keeping the saws in working order. Some remarks by M. Powis-Bale, in recent numbers, are good, but, like most other writers, he fails to give the length and number of teeth, also form of teeth. They say teeth should not be too long, neither should they be stumpy. Now, the question may be asked, what is too long, or what would be considered stumpy? Now as these important points are not given, I have come to the conclusion that the writers of these papers would prefer one who has had some experience to give his opinion as to what has proved to be the best space, length, etc., of saw teeth. Now for soft wood generally, the space between the teeth should be greater than for hard wood, the teeth longer and the angles more acute. A saw that is used for cutting nothing harder than yellow, red, or white pine, teeth to the number of 50 will answer well if properly sharpened. Then the question may be asked, 'For what sized saw?' My reply is of any diameter. It is the custom where there is more than one saw bench at work, when the saws for the larger benches are reduced to a certain diameter, to get them ground thinner and work them in a smaller bench. As the saw is reduced the teeth of course become closer, and the speed of the smaller bench or saw is increased, so that at the point of teeth the traverse is as great as in the saw of greater diameter. The annexed sketches give the distance of teeth in a 52 in. circular saw with 56 teeth, and the distance of the teeth when reduced to 36 in. So you will at once see if a 52 in. saw was, with the distance of teeth, not greater than in one of 36 in., there would be far too many teeth. The reason I give sketch of 56 teeth is, in many sawmills the same saws have to be used in cutting elm, ash, beech, etc., occasionally; therefore, I draw a line between the number of teeth for soft and hard wood generally. The length of teeth in Figs. 1 and 2, space and rake, I have proved

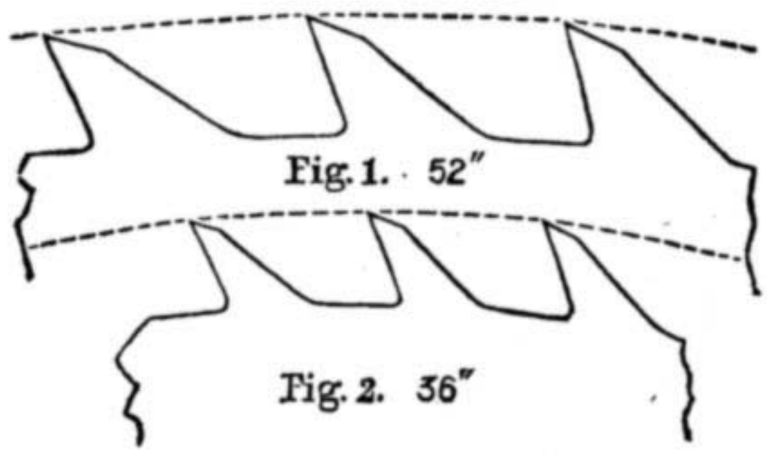


Fig. 1. 52″

Fig. 2. 36″

to answer well for general work; it will also be seen by the difference in the length of teeth in Figs. 1 and 2, how the length should vary in proportion to the diameter of the saw. As to a greater number of teeth in a thin saw, should a saw be kept for special work, such as a swage saw, the number of teeth should be greater than above mentioned. Again, would you recommend teeth as in Figs. 1 and 2 for saws cutting English-grown timber, such as ash, elm, oak, etc.? Precisely the same form, but the rake and bevels not so acute. Some may say that the teeth should be as in Fig. 3, but I object to this form of tooth; in the first place, it requires more topping and more power to drive it; secondly, it is more difficult to set; thirdly, although there is more steel in the tooth, it will not stand to its work well, the back of teeth being more upright and the angles so sharp at A, A; the tooth is not so strong as if there was more bevel at the back and round at the angles, as in Figs. 1 and 2. The back being bevelled, supports the tooth as it is thrust into the timber, and round at the angles strengthens it. Teeth for cutting the last-named woods only should be about ¼ in. shorter than given in Figs. 1 and 2, and the number from 60 to 66; if much longer, and come in contact with a hard knot, or a "curl," as we term it, the teeth will chatter, lose their set, and, in consequence, cause the saw to run out of truth. There are many forms of teeth given by makers, but it has been proved the chisel form, as in Figs. 1 and 2, is the best form for general work. Again, I believe it is generally understood that the greater the diameter of the saw the stouter the plate. Now to set the teeth of a stout saw is not an easy matter for an amateur: many a good saw has been considered inferior through the ignorance of the one that had the sharpening of it. Not having a fair knowledge of how to set the teeth, they often break a tooth; they take a one-handle 'set,' and on a thick plate commence to bend away and press on the handle as though they were trying to break it off; finding the tooth does not bend so easily as they would wish, they put more strain on the handle of the 'set' and off snaps the tooth. Then it is said the saw is of inferior quality, and that saws made by such and such a maker are not as good as those made by so and so. This tale is carried around, which in the long run does the abused maker no little injury, and all through the ignorance of the abuser. I might say that I have set circular saw teeth of thin and

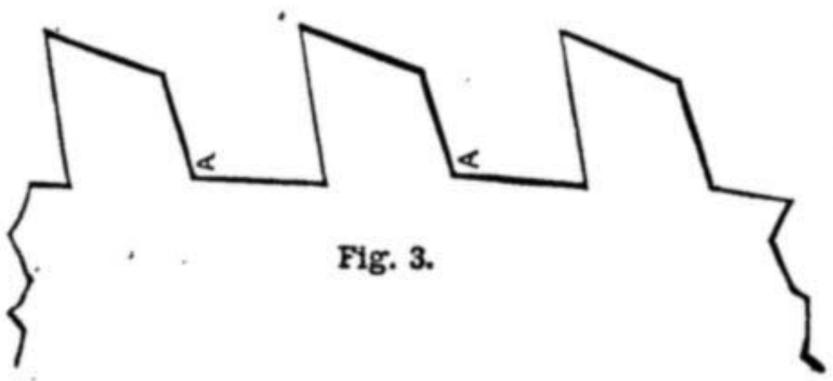


Fig. 3.

stout gauge many thousands of times, and have not broken on an average one tooth a year in setting, unless the tooth was defective before setting. The way I set all stout circular saws is as follows:—I use a two-handle set about 20 or 21 in. long, as Fig. 4. I place it down over the tooth about one-third its depth, and if the tooth is to be set toward the right hand I gently pull the handle in

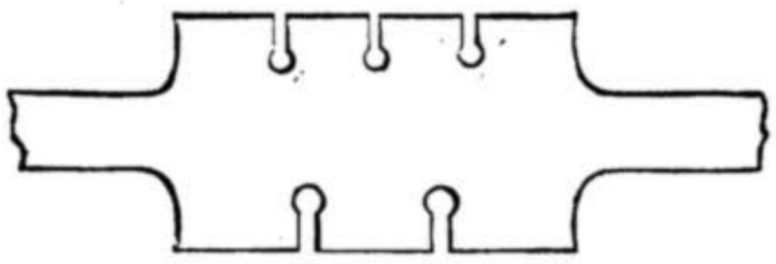


Fig. 4.

my right hand toward me, and push the handle in my left from me. Then I take a gauge made of a thin piece of steel (as Fig. 5) and place it against the saw plate, holding it at right angles and bearing at G, G; if the point of tooth touches the gauge at S, it has set enough; if not, twist the tooth a little more until it touches the gauge; then move on, and set every alternate tooth on that side. Then take the gauge in the left hand, and set every alternate tooth in like manner on the left hand. You will clearly see, by using the set as described, that the point of tooth is twisted and not levered down on and sprung. Now the question may arise, 'Will the same gauge answer for saws of any diameter?' Of course not. A saw that will cut through a piece of timber 24 in. deep requires more set than one that will only cut through 12 in. deep; therefore, where several saws of different diameters are at work, some five or six gauges will be required to keep saws in good order; to give the amount of set for each saw, and for every kind of wood, would take a deal more space, on which I am afraid I am encroaching, but shall be always pleased to answer any question on the above. In reference to fence projecting 3 or 4 in. beyond root of saw teeth, as stated by M. Powis-Bale (see Vol. II., page 203, cause 14), I beg to say it is a mistake: only in cutting very thin stuff should fence project beyond the teeth at all; as in general work, it will cause binding on the saw, which should by all means be avoided. Much more might be said in reference to saw teeth, but enough for the present."

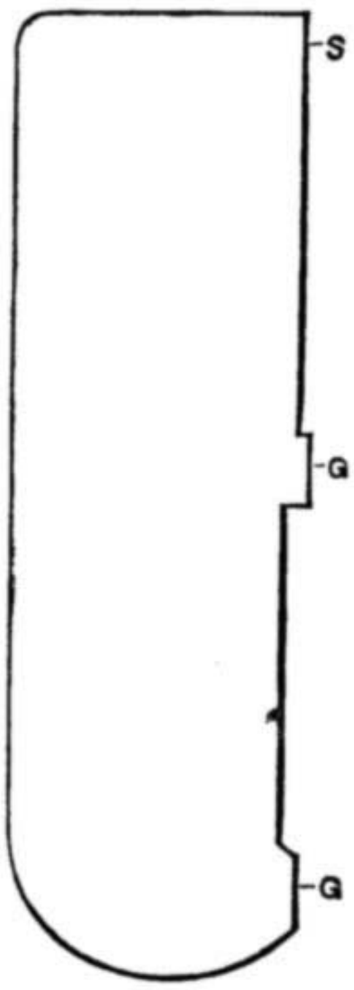


Fig. 5.

II.—Questions Answered by Editor and Staff.

Telephone Parts.—H. S. (*Stoke Newington*).—I am very sorry that I am unable to make out your sketch of telephone connections, and therefore cannot tell you whether you are right. If you have made all the various parts and connected it up as shown, you will lose nothing by experimenting, and perhaps you will then be able to answer your own question. You might have easily designed a simpler switch than the mahogany wheel; certainly it seems quite ingenious, but I think I should prefer an arrangement not quite so complicated. With a single cell of the Leclanché type you could not expect to establish a communication of any great distance. It would be much better to have a little spare current, so I would advise you to get one or two more cells. Your former query reached me all right and was replied to; have a little patience, and you will see it in due time.—W. D.

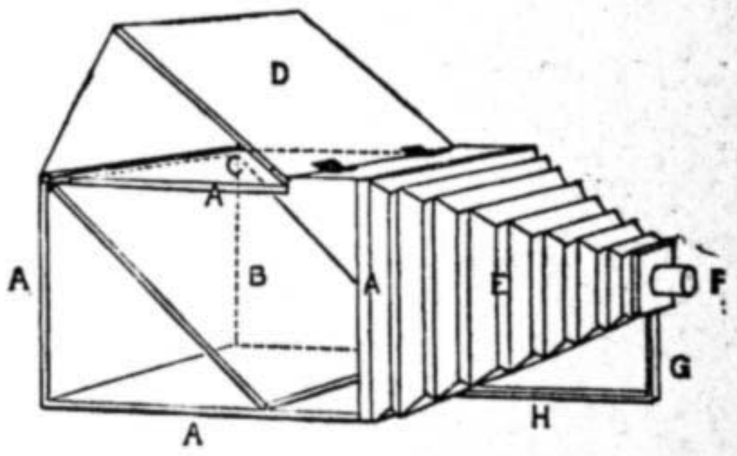
Speed of Band Saw.—P. F. (*Liverpool*).—The speed of your band saw for your work should be from 4,000 ft. to 4,500 ft. per minute. You say you are using ¾ and ⅝ band saws with teeth three to the inch, and want to know if two to the inch would be better. Certainly not; it would be making a bad matter worse. The number of teeth in the ¾ saw should be 4½ or 5 points to the inch, and in the ⅝ saw 4 points to the inch. I have band saws at work running at the above speed and cutting hard wood, chiefly doing superior work. If your saws are properly sharpened and speed regular, with the above speed and number of teeth they will do good work. You should have given diameter of wheels and number of revolutions, so that I might know whether you have rightly calculated the speed of your saw. Your wheels may be 36 in. diameter, and you may be calling the circumference 9 ft. or three times the diameter; if so, the speed of your saw would be greater than the speed you give. To find the circumference of your wheels you should multiply the diameter in inches by 22 and divide by 7; this will give the circumference in inches, which, divided by 12, will give the number of feet.—A. R.

Pattern Making.—Square Centre.—It is intended to give articles on pattern making in WORK, but it is not possible to say when they will be likely to appear. I am quite aware of the desirability of such papers, and when they are given I wish them to be the best possible.

Copyright.—M. McQ. (*Cockermouth*).—The cost of entering title, etc., of a book at Stationers' Hall is about 5s.

Moulding Shellac and Emery.—Bristol.—If you give your moulds an even coating of blacklead and beer, I think you will overcome the difficulty mentioned in your query. Not knowing shape or size of the articles you require to make, I cannot, of course, give you more explicit directions. I have not found this substance difficult to manage in the way you complain of; remember always to *keep up the heat* until the moulding—*i.e.*, pressing into the moulds—is accomplished; do this "by hook or by crook," even at the risk, I may say *certainty*, of burning your fingers; otherwise you will find any mixture in which shellac is the chief ingredient will *go against you*.—Opifex.

Camera Obscura.—G. McK. (*Glasgow*).—Make a light box 10 in. square with a cone in front to support the lens and provide sufficient focal length. A piece of silvered glass is placed at an angle of 45 degrees to the lens, and to a sheet of ground glass directly above it, a screen to cut off outside light and assist in seeing the image on the ground glass, complete the arrangement. The instrument should be stained a dead black inside. The accompanying diagram will explain its construction.



A A A A, a wooden box, 10 in. square; C, ground glass screen, on which the image is reflected; B, mirror, set at an angle of 45°; D, lid over the ground glass, hinged to box with thin side pieces to act as a screen when raised, and fitting down by the side of the box when closed; E, conical extension made of any opaque fabric; F, lens supported by rod G, attached to sliding bar H, slipping under box, when out of use for portability, or the whole might be made as a simple oblong box. The kind of lens may be either a single landscape lens or double convex lens of about 12 in. focus.—E. D.

Lessons on Turning.—J. M. B. (*London, W.*)—No doubt this subject will be treated; meanwhile, if you can buy or borrow Holtzapffel's "Turning and Mechanical Manipulation," Vol. IV., you may see the subject about as clearly treated as it is possible, and it will probably leave on your mind the impression that, though description may assist, a little "showing" is still more essential to a beginner.—F. A. M.

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Building Trades Examinations.—STUDENT, WORKMAN, W. B. (*York*), and others.—Below you will find the questions asked on the above subject by the Science and Art Department of South Kensington for this year (1890). I have appended the rules for the benefit of readers generally. I have omitted the honours questions, as you did not ask for them, but if you wish it I will let you have them in another number of WORK.

GENERAL INSTRUCTIONS.

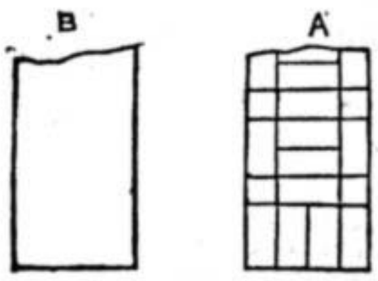
If the rules are not attended to, the paper will be cancelled. You may take the elementary or the advanced or the honours paper, but you must confine yourself to one of them. Your name is not given to the examiner, and you are forbidden to write to him about your answers. All figures must be drawn on the single sheet of paper supplied, for no second sheet will be allowed. All drawings must show a correct knowledge of construction. Neat, distinct, and accurate pencil drawing to scale is required. No extra marks will be allowed for inking in. Where only sketches are asked for, the proportions must be approximately correct, though extreme accuracy, as in drawings to scale, is not necessary. You are to confine your answers strictly to the questions proposed. Put the number of the question before each answer. Answers in writing must be as short and clearly stated as possible, and close to any figures to which they may refer. The value attached to each question is shown in brackets after the question. But a full and correct answer to an easy question will, in all cases, secure a larger number of marks than an incomplete or inexact answer to a more difficult one. A single accent (′) signifies feet; a double accent (″) inches. *The examination in this subject lasts for four hours.*

FIRST STAGE, OR ELEMENTARY EXAMINATION.

INSTRUCTIONS.

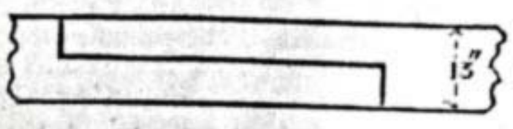
Read the general instructions. You are only permitted to attempt seven questions.

1. Plan A represents one course at the end of a brick wall built in Flemish bond. Draw to a scale of 1 in. to a foot, making any alteration you think necessary. Also draw plan B, showing the arrangement of the bricks in the next coarse.



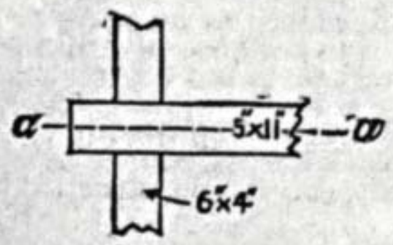
2. Give a sketch elevation showing a portion of a stone wall built of squared rubble worked up to courses.

3. Elevation showing two 13 in. square balks of timber halved together. Draw the joint to a scale of ½ in. to a foot, but showing it tabled and secured by hardwood wedges, without any bolts.



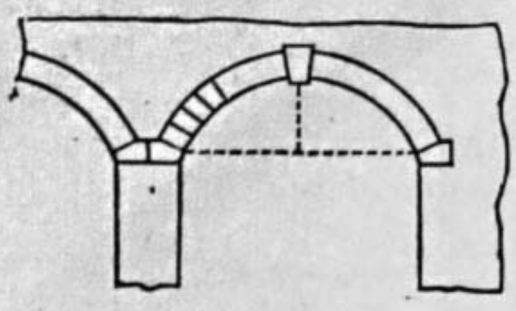
4. Plan of a beam cogged on to a wall plate. Give a section through *a a* to a scale of 1 in. to a foot.

5. Elevation of a stone arch. Draw to twice the scale, and write on it the names of all the different parts of the structure.

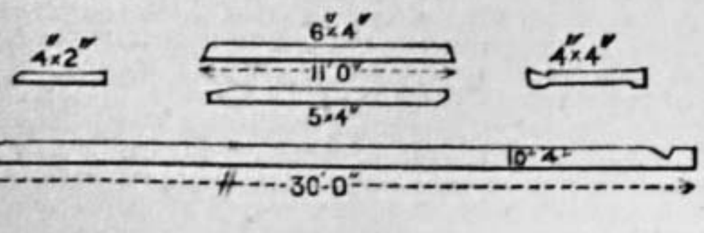


6. Explain by aid of sketches the meaning of the following terms:—wood plugs, lead dots, double quirk bead, wood lintel.

7. Parts of a roof truss. One member of each kind being given. Draw the truss to a scale of four feet to an inch, writing down the name of the truss and of its different members, including any ironwork.



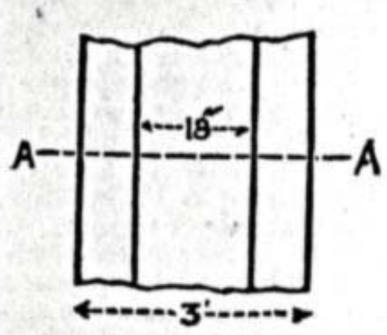
8. Plan of part of an 18 in. brick wall built in English bond, showing also the width of the bottom course of footings. Draw the plan to a scale of ¾ in. to a foot, filling in the bricks in



the 18 in. course only. Draw a vertical section through A A, showing the arrangement of the bricks in the footings; no offset to be more than a ¼ in. brick.

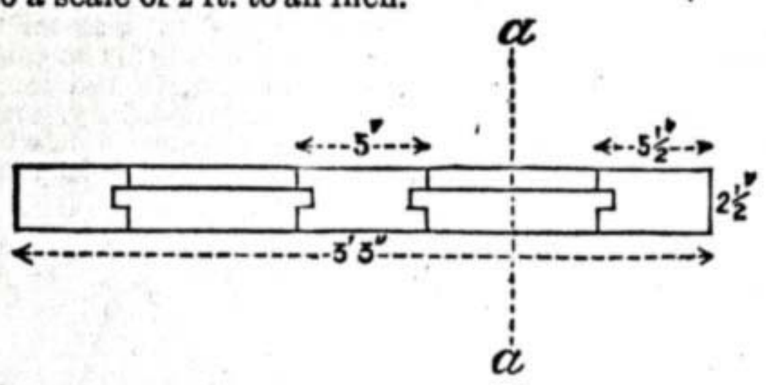
9. A cast iron cantilever is 10 in. in depth, and its flanges are respectively 4 in. by ¾ in. and 8 in. by 1¼ in. Draw its section in position, one-third full size.

10. Horizontal section through a four-panelled door 7 ft. high. Draw its outside elevation and a vertical section through *a a* to a scale of ¾ in. to a foot, showing the top panels, bead, and butt, and the bottom panels, bead, and flush.



11. Draw to a scale of 1½ in. to a foot a section through the eaves of a roof, showing 4½ in. by 2 in. rafters, 3 in. by 1 in. battens, carrying 24 in. slates. Show four courses of slates, centre nailed, and laid to a 4 in. lap.

12. An iron roof truss over a 24 ft. span consists of T iron principals 3 in. by 2½ in. by ½ in., two angle iron struts, 1½ in. by 1½ in. by ½ in., and five tension rods of ¾ in. diameter. Draw the elevation of about half the truss to a scale of 2 ft. to an inch.



13. Draw a cross section, to a scale of 1 in. to a foot, through an 8 in. lead gutter with step flashings, formed at the end of a boarded and slated roof butting against the brick wall of another building; also show the step flashings in elevation.

14. Draw a vertical cross section, to a scale of 1½ in. to a foot, through the foot of a wooden kingpost; and a tie beam 5 in. by 11 in., showing all the details of a stirrup iron ¾ in. thick properly wedged up with gibs and cotters.

SECOND STAGE, OR ADVANCED EXAMINATION.

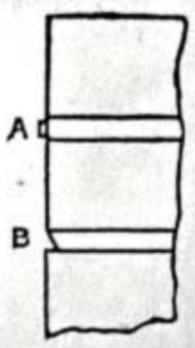
INSTRUCTIONS.

Read the general instructions. You are only permitted to attempt six questions.

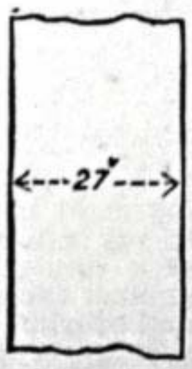
15. What is the difference between single and double laths, and what does the first coat of plaster on ceilings ordinarily consist of?

16. When ought timber to be felled, and why? What is American yellow pine chiefly used for?

17. Sketches of two forms of mortar joints, one being known as tuck pointing. Draw them to twice the scale, giving each its proper name, and state your views as to their merits, also making any alteration you think advisable.

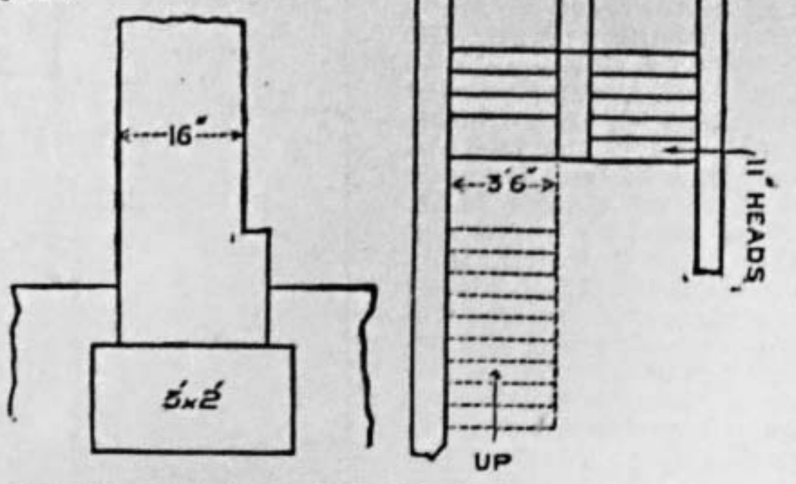


18. Cross section through part of a brick wall faced with ashlar. Draw to a scale of 1 in. to a foot, showing its construction.

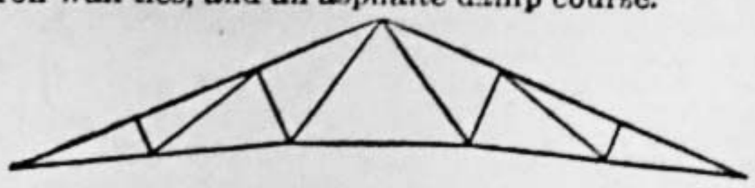


19. Explain by sketches the meaning of the following terms: "facia and soffit boarding to eaves," "dragging tie or dragon beam," "flitched girder," "torus moulded skirting."

20. Give an elevation and longitudinal section, one-half full size, of each of the following joints in a 1¼ in. lead pipe: a wiped joint, a blown joint.

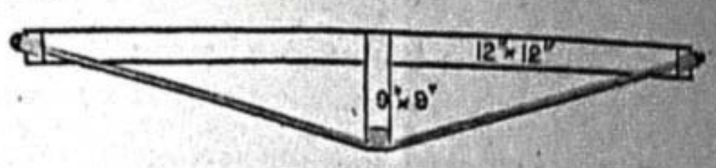


21. Cross section of a hollow brick wall resting on a concrete foundation. Draw to a scale of ¾ in. to a foot, showing the hollow space next the outer face, iron wall ties, and an asphalte damp course.



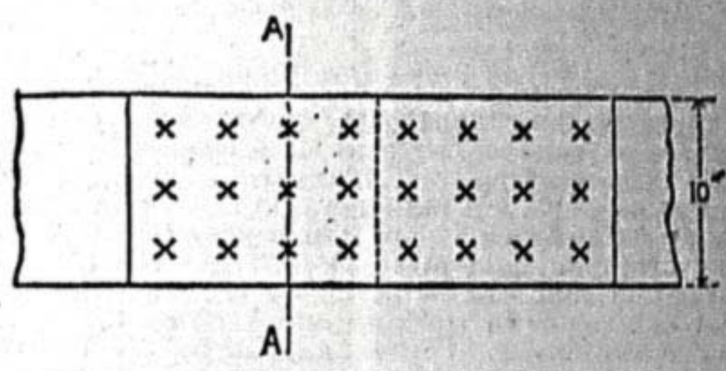
22. Plan of a stair. Draw to a scale of ¼ in. to a foot, showing the handrail by double lines and newels; also giving the name by which it is known, and the names of its different parts. Give to a scale of 1½ in. to a foot an end elevation of two of its steps, showing return moulded nosings and a sunk and moulded string.

23. Line diagram of an iron roof truss. Draw to twice the scale, showing the members in tension by single lines and those in compression by double lines.



24. Elevation of a beam of a traveller running on a gantry. Give an end elevation of the traveller to a scale of ½ in. to a foot, showing how it is carried on the gantry.

25. Plan of a double cover riveted joint in a ¾ in. tie bar, showing the positions of the rivets. State the nature of the joint, having regard to the arrangement of the rivets, and draw a section, one-third full size, through A A, showing ¾ rivets to a 3 in. pitch, with snap heads above and pan heads below.



26. Draw, to a scale one-sixth full size, a vertical section through a window back, showing a coursed rubble wall 12 in. thick, with both stone and wood sills, and the bottom rail of a 2½ in. double hung sash. The back lining to be 3 ft. high to sash, with moulded panels, and to be box framed, showing vertical sliding shutters in two 3 ft. 6 in. leaves.—E. D. [The working out of these questions will appear subsequently.—ED.]

Electro Motor.—F. H. (*Euston Road, N.W.*).—To make an electro motor capable of driving a sewing machine, I should advise you to get a set of Manchester type motor castings to the following dimensions:—armature, 3¾ in. diameter by 2 in. deep; field magnet cores, 1½ in. diameter by 4 in. long, connected by yokes 8 in. long and 2 in. wide. Wind the armature with 1 lb. No. 20 double cotton-covered copper wire, and the field magnets with 1 lb. of No. 16 double cotton-covered copper wire, connected in series with the armature coil. This machine will take about 4 ampères of current at a pressure of 12 volts to drive a sewing machine. The current can be furnished by a battery of 6 quart-size chromic acid cells, or one of 12 nitrate of soda cells. The castings and wire, together with instructions, can be obtained from Mr. S. Bottone, electrical engineer, Carshalton.—G. E. B.

Safety Bicycles.—S. B. H. (*Birmingham*).—Your letter is not quite explicit as to what kind of an article on safety bicycles you require. Would you read the article on the front page of WORK, No. 66, for week ending Saturday, June 21, 1890, and say if that is what you want. A continuation of that article, giving hints on riding, pedalling, etc., is to appear in WORK shortly. Probably you would like an article on how to build a safety machine. If not, and the above printed article does not suit your requirements, kindly write again, saying what style of paper you wish to appear.—P. B. H.

Turning Oval.—W. B. (*Crosland Moor*).—There have appeared several sketches of "oval chucks" for turning work of elliptic (not oval) section, and I understand a contributor has written a paper on the "oval chuck," which will probably give you the information you require. It is not easy to thoroughly understand the action of the "oval chuck." If I had you here to look at mine, you would see it work, and might easily learn to use the chuck, but you would probably not be able thoroughly to grasp its action. It cannot be explained in a few words in the "Shop" column, and you had better wait for the article. The chuck is a very beautiful mechanical contrivance—well worth studying.—F. A. M.

Phonograph.—H. W. (*Strabane*).—I cannot say whether the articles on the phonograph will be published in the present volume of WORK or not: that remains with the Editor, who will doubtless do what is possible in the interests of the readers.—W. D.

Clockwork.—J. W. (*Wolstanton*).—Britten's "Watch and Clockmakers' Handbook, Guide, and Dictionary" may be had through any bookseller, or from the editor, I think, at the Horological Institute, Northampton Square, Clerkenwell, London; or Grimshaw & Baxter's, 35, Goswell Road, Clerkenwell, or any other watch tool shop. By ordering from the booksellers you save postage, and may get a reduction beside.—A. B. C.

Polished Cast Iron.—J. D. (*Birmingham*).—Assuming you desire a blue colour, try the following:—Fill an iron pan with clean brass filings, sand, powdered charcoal, or mahogany sawdust, heat the pan to a low red heat, and pass and repass the articles through its contents until the desired colour is obtained. There must be no trace of grease on the articles to be blued. Dissolve four ounces of hyposulphite of soda in a pint and a half of water, and add a solution of one ounce of acetate of lead in one ounce of water. Boil this and let the articles remain in it until blued.—J.

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Inlaying.—JOE (*Liverpool*).—Busschott, Park Lane, Liverpool, generally has a fair stock of stringing for inlaying. If you have not done so, try him for what you want. For centres go to Urquhart & Adamson, Cabinet Makers, Bold Street. If they have not got them they will make them for you.—D. D.

Inlaying.—W. D. (*Perth*).—There is only one book published which gives the process of marquetry inlaying as practised by professionals, viz., "The Art of Fret Sawing and Marquetry Cutting," by David Adamson, published by Ward, Lock & Co. The subject will be treated of in WORK in course of time, but I am unable to say when. Do not attempt to dye the veneers yourself. They can be bought at very low prices in almost any colour, and the process is both difficult and tedious.—L. J. P.

Hammock Stand.—L. W. (*Wantage*).—You do not say whether you want your hammock stand to be for out or indoor use, or whether it is to be a fixture or movable. I am, therefore, at a loss to know how to help you with minute details, as you must see it is impossible to go closely into construction of all kinds. I may, however, suggest posts stuck into the ground for permanence out of doors, or a couple of tripods over which the hammock ropes can be slung and fixed beyond to stout pegs in the ground, or hooks screwed into the flooring. If you want further assistance, send full particulars of what you want.—D. D.

Hanging Sash.—NUR THENE.—I think, by telling you how to put new sash lines to both top and bottom sashes, I shall answer your three queries at once. For if you can put lines to both sashes it goes without saying that you can put them to either top or bottom, as the case may be, always bearing in mind that you must take out the bottom sash to put a line to the top one. Some men who are accustomed to this work only undo one line of the bottom sash, letting it swing out of the way, resting it on any available projection or piece of furniture, or held by an assistant, when putting a new line to the top sash. But it is not to be recommended except in the case of very light sashes, and certainly not by an amateur. We will now suppose that all four lines are broken in an ordinary window. The first thing necessary to do is to take out the sash beads, marked A in Fig. 1: this will release the bottom sash, which you now lift out, taking out the broken pieces of cords, noting how they are fastened off, and stand it aside. Now take out the parting beads, marked B. If you have any difficulty in doing this it can easily be managed by inserting a thin chisel behind them and prising, being careful not to break them. You can now take out the top sash, and serve it the same as the other one. Next take out the pocket pieces marked C (if only one line was broken, it would only be necessary to take out the corresponding pocket piece): this will enable you to lift out the weights, noting which are for the front and which for the back sash. Sometimes when two lines are broken on one side it is rather awkward to get out the weights, but it can easily be managed by lifting one straight up above the aperture and pushing the parting slip aside. If you hold this tightly against the raised weight, you can readily take out the other; and when one is out the other is an easy matter. Next take out the pieces of broken cords from the tops, taking notice how the knots are tied. You are now quite ready to put in the new lines; and to do this the first thing necessary is to provide a small piece of lead about ¼ in. round and 4 in. long, also a piece of whipcord about as long as the sash frame is high. Tie a knot in one end of the cord, flatten out one end of the lead, and lay the tied end of the cord on the flattened part of lead, as Fig. 2. Now close the lead tightly round the cord, and the knot will prevent it pulling out. This is called a mouse. Next fasten the other end of the cord on one end of your new sash line, as Fig. 3. The lead should now be pushed carefully over the pulley wheel D, just bending the mouse to enable it to fall into the space behind. The weight of this will drag the light cord after it. Gently guide this cord over the wheel (taking care it does not get between the wheel and cheek of pulley) until you can see the lead directly behind the hole from which you took the pocket piece. Now take hold of the lead and carefully pull the rest of the cord over the wheel: this will pull the sash line after it, and when you attempt to pull the sash line through the pulley you will at once see the advantage of tying the thin cord on the sash line, as sketch: for the harder you pull the smaller the end E becomes, and the turn at F prevents it slipping off. If you have any trouble in getting the sash line over the pulley (providing it is not too large), you must guide it over, letting someone pull the mouse at the bottom. Pull sufficient of the sash line through to enable you to pass the mouse through the hole at the top of the weight, and pull the sash line after it. When the sash line is through the hole in the weight, take off the mouse and tie a knot in the end. Now insert the same end back in the hole at side of weight, and hold the weight by the cord with one hand, and hammer the knot in the side hole. This method prevents the end of the cord sticking out from the side of the weight and catching against the sides of the frame, and preventing its running up and down freely. The weight should now be got into its place by pulling that part of the lines left standing out from the face of the pulley, pushing the parting slip aside and leading the weight into its place. Next pull the weight right tight up to the back of the pulley, stretching the line as much as possible; and whilst you hold the weight up as far as it will come by the cord, lightly drive a clout nail through the cord into the wood below the pulley, as G. This will hold the weight up for the time being, letting the rest of the cord hang loose. If you now stand the top sash upright on top of the window sill, you can at once see how long you want the line to be, and it can be cut off, taking care that you do not leave it too long. If it is too long the bottom of the weight will touch the sill before it has pulled the sash quite home, and you will have to take the sash out again to shorten the cord after the said sash is hung. This is also the reason that you stretch it as much as possible before cutting it off. Now proceed with the line for the front sash in the same manner, with the difference that when you stand the bottom sash on the sill to get the length of the cord, be sure to allow it long enough to enable the sash to come right down on the sill when it is hung. This completes the lines for one side, and you can now serve the other side in the same manner. You need not offer the sashes up again, because you have the lengths of the cords already determined. A man that is used to the work would thread the whole of the lines at once by passing the cord over one pulley and out at the hole at the bottom, and over the opposite pulley and out at the hole at the bottom, and so on, without taking off the mouse. But this sort of thing only comes with practice. Next proceed by nailing or fastening with knots the ends of the lines to the top sash, and put the sash in its place. The weight of the sash will now be hanging on the two nails G under the pulley. Pull out these nails, and your top sash will be hung. Now try it, and remedy anything that is not quite right before replacing the pocket pieces. If it is all right, put in the pocket pieces and parting beads, and follow with the bottom sash in the same way; after which put in the sash beads, and if you have not broken a square of glass it will be finished. This seems a long explanation for a little job which I could explain to you personally in a few minutes, and even now I have had to omit several little wrinkles which I would have liked to mention. But if you will read this carefully before you start you cannot fail to succeed, if not at the first attempt, for certain at the second.—E. D.

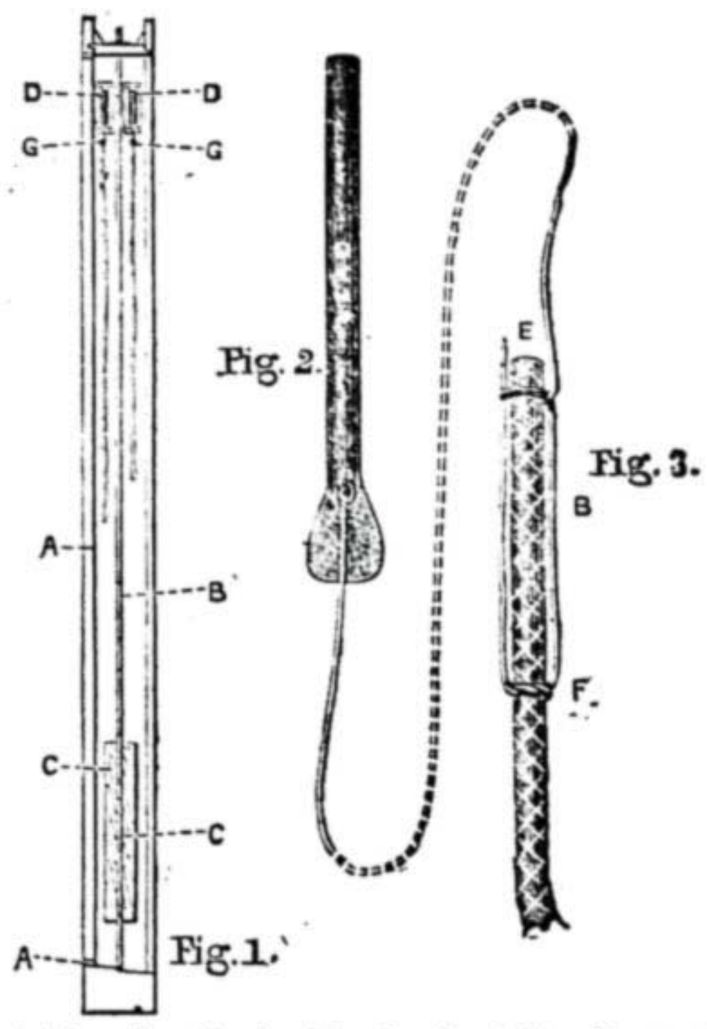

Fig. 1. Fig. 2. Fig. 3.

Sash-Hanging Parts. Fig. 1.—Sash Beadings, etc. Fig. 2.—Lead flattened and then bent round Cord. Fig. 3.—Method of fastening Mouse on to End of Sash Line.

Composition for filling Pearl, etc.—ANXIOUS.—Sealing-wax dissolved in methylated spirit of wine will very well answer your purpose. Put into a strong glass-stoppered bottle as much sealing-wax as the spirit will dissolve, and add to excess, so as to get a saturated solution; do not put the stopper in until the solution is made. If you place the bottle in a basin of hot water more wax will be dissolved. Always wipe off inside of neck with a rag and fresh spirit any solution that remains after pouring, before putting stopper in. Then paint in all lines in the pearl, or ivory, or metal (for it answers also for any metal) with a brush, until quite full. When dry, rub over with a bit of cuttle-fish bone till the hard wax is level with the surface, and polish the pearl or ivory if scratched, and burnish with an agate burnisher. Then spirit off as in French polishing. If the engraving is on metal, warm the metal over a lamp as the wax dries, and leave to cool; when cold, level down with crocus and oil on a cork pad or with a piece of oily charcoal, and finish with crocus on a felt pad; rub bright with a piece of clean buff leather and whiting. For coloured filling, use red, blue, green, or other sealing-wax, according to requirements. Get the best.—J. W. H.

Turbine to drive Dynamo.—T. L. (*Peckham*).—A one-man-power Thirlmere water motor, costing about £3 3s., will drive your small dynamo to light up three 5 c. p. lamps. This could be adapted to be driven from the water supply of your house if this is constant; but you would have to make special arrangements with the water company before you could use their water for such a purpose. Write to Bailey & Co., Salford, Manchester, respecting turbine.—G. E. B.

Platinum Pin.—W. H. H. (*Huddersfield*).—Try W. Bowker & Co., electricians, Henry St., Huddersfield, or Messrs. Sunderland, Halifax Old Road, Huddersfield, and ask them to oblige you with a bit of No. 18 or No. 20 platinum wire, telling them what you want it for. It may cost you 6d. A pin of platinum is best, but you may use German silver as a makeshift, or solder a fragment of platinum foil to a brass pin.—G. E. B.

Copying Apparatus.—C. W. (*Airdrie*) asks for a practical opinion of the "Eclipse" copying apparatus. I have made a personal trial of it in the interests of C. W. and other readers of WORK, and am thus enabled to give the following description of it:—Firstly, on any fairly good hard-sized paper write or draw, with the ink supplied, any required matter or subject. Secondly, damp with a sponge any one of the six graphs (supplied with the machine), and lay your original down upon it with a slight pressure, just sufficient to expel the air and to ensure contact. Let it rest thirty seconds. Gently raise one corner and peel off the original. Thirdly, having spread the printing ink (supplied) on the slab, roll it evenly until the roller (supplied) is evenly charged; roll up the graph till it is quite black and clear. This requires no previous experience. Then lay a sheet of any paper you like down on it and gently press it either with your fingers, your palm, or the rubber (supplied). Pressure enough to secure intimate contact is sufficient, no force being necessary or advisable. The first proof is not the best; as the job gets evenly charged it prints better and better. Copies of typewriting can be thus transferred and reproduced. Each graph will give six perfect originals. They only cost 1s. each for renewals. After an original is done with, wipe it off with the solution (supplied) for thirty seconds; the negative is destroyed, and in a few minutes the graph is again ready for another original. If desired originals, written with the special ink, will last any length of time, and go down as well as if quite fresh, large numbers can be printed from one transfer if required. The ink for printing is black, and can only be distinguished from writing ink used with the ordinary pen by an expert. Ferns, leaves, grasses, etc., can be copied direct by rolling them up with the ink, and being printed in oil, they can be readily transferred from paper to mirrors, silks, calico, wood, etc., for decorative purposes. It is claimed that no special pen, no special paper, no stencil, or wet parchment sheets, no aniline dye or ordinary graph, and no preparation, are required. In one minute after the original is dry a proof can be obtained, and the requisite copies can be gone on with at once. The prices are as follows: octavo, 6½ in. by 9½ in., in box complete, with all requisites, and six graphs, £1 10s.; quarto, 9½ in. by 11¾ in., £2; foolscap, 10 in. by 15 in., £2 5s.; brief, 14 in. by 18 in., £2 10s.; 14½ in. by 22 in., £3; Messrs. Fordham & Smith, Helmet Buildings, Wormwood Street, E.C., are the sole proprietors.—J. W. H.

Ink for Graph.—CENTUMGRAPH.—For black ink for graph (which is protected by patent) I should recommend you to write to the makers of the "Eclipse" copying apparatus, Messrs. Fordham and Smith, Helmet Buildings, Wormwood Street, E.C. (see also above reply to C.W. (*Airdrie*). The "Eclipse" gives a very large number of copies in *black*, jet black, ink.—J. W. H.

Celluloid.—J. B. H. (*Barnes*).—I cannot give you particulars of the manufacture of celluloid, which, in any case, you could not make yourself without a very large expenditure and skilled assistance. If you want some, your best plan will be to write to the British Xylonite Company, 124, High Street, Homerton. They sell it at 4s. per lb. and upwards.—D. D.

Mail Cart.—A. O. (*Manchester*).—Instructions and designs have appeared in No. 30, Vol. I., of WORK, which can still be procured from the publishers. The general height of a mail cart is 2 ft. 6 in., measuring from the ground to the top rail.—W. P.

Engine Governor.—J. M. P.—J. M. P.'s experience would seem to show that, in my desire to be on the safe side, I have recommended a governor rather larger than was quite necessary. Still, if the throttle valve should stick at all, the larger size would, of course, have the advantage. I am glad J. M. P. has given the result of his experiment, and should like to know how he estimated the variation in speed permitted by his governor, trying it with work full on, and then suddenly thrown off, as when driving band comes off fly-wheel.—F. A. M.

Violin Bass Bar.—M. H. T. (*Birmingham*).—The correspondent you name did not disclose the nature of his "discovery," so therefore I am unable to give any information regarding it.—B.

Bicycle Makers.—E. G. (*Sheffield*).—The following are a few of what are generally considered the best bicycle makers, together with their addresses:

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—Humber & Co., Limited; works—Beeston, Nottingham: depot—32, Holborn Viaduct, London; Rudge & Co., Limited; works—Coventry; 23, Holborn Viaduct, London; Starley Bros., St. John's Works, Coventry; 21, Holborn Viaduct, London; Coventry Machinists' Company, Limited; works—Coventry; 15 and 16, Holborn Viaduct, London. There are other makers nearly, if not quite, equal to some of the preceding, but most probably these will be sufficient for your purpose. I have heard it often remarked that as regards design of machine, the first of the firms here mentioned cannot be surpassed. Most probably these firms will have either depôts or agents in Sheffield.—P. B. H.

Violin Making.—R. J. C. (*Deptford*).—Papers on this subject are in the Editor's possession, and only wait their turn for insertion.—B.

Detective Camera.—Yes; the lens is quite suitable for magic lantern. In your case the plates might be covered on the back with ruby paper—gummed on—and set one behind the other in the camera: the paper to be folded over the edge of the plate about the eighth of an inch; a piece of card projecting a little above the plates placed between each, and nicked on the top edge with one cut for each plate 1, 2, 3, 4, and so on. The apparatus may be enclosed in a light bag, with a sleeve contracted with elastic at two points, through which the hand could be thrust to change the exposed plate from the front to the back. The nicks on the edge of the cards, which can be easily felt with the finger tip, indicate which plate is used, the card and plate being simply lifted together from front to back after exposure. A spring at the back is required to keep the plates pushed forward to register, a thin piece of wood dividing the exposed plates from the unexposed ones. When this is reached, it is known that, providing the plates have been removed in rotation, all have been used. The number of plates is only limited by the capacity of the camera: a few or many can be worked with equal facility.—D.

Mixing Materials for and Glaze for Porcelain.—E. J. C. (*King's Cross*).—I am unable to advise as to the exact proportions of China clay and Cornish stone. I believe they vary in the hands of different makers and for different purposes. In English porcelain rather a large proportion of calcined bones is also used. The white glaze for English porcelain is said to be ¾ felspar and ¼ lead. For the harder kinds, felspar only or felspar and a little gypsum are used; and for the softer, something like half lead. Much has been written about china and china-making, but I am not able to give the title of a book such as E. J. C. requires.

Truck Coupling.—H. J. B. (*Cirencester*).—A very large number of automatic truck couplers have been patented, and I should advise you before taking any steps involving expense to search the patent records and assure yourself that you are not anticipated in your invention. Provision is made in most to obviate men passing between the trucks. Not knowing the character of your design I cannot advise you on this point. I do not think any of these contrivances are extensively used. If, however, you wish to bring your invention out, the best course is to get the authorities of some important railway to give you permission to make a trial of it in connection with their rolling stock, when, if perfectly successful and simple, you may find capitalists to take it up. If you send a sketch I may be able to give you an opinion as to the probability of success.—F. C.

Metal for Valves.—ALKAME.—Neither gun metal nor cast iron would be very durable. Manganese bronze or delta metal would be far superior. But you should state what you want the valves for when ordering, because each alloy is made in various grades.—J.

Metal Work Black.—T. H. (*Borough, S.E.*).—Use Judson's artists' black.—J.

Steel Lamina.—W. W. (*Torquay*).—Butterworth & Co., Marsh Street, Bristol, sell steel sheets from which you can cut your strips.—J.

Cement for fixing Iron in Wood which will resist Water.—G. H. (*Small Heath*) wishes to fix wire nails firmly in holes bored in wood with a waterproof cement. I do not know that he could have anything better than half red and half white lead thinned as far as necessary with boiled oil; or he might try dry white lead mixed with gold size to a paste; or again, indiarubber heated till it smokes and becomes viscid, mixed with half its weight of red lead, and a little powdered whiting or lime.—S. W.

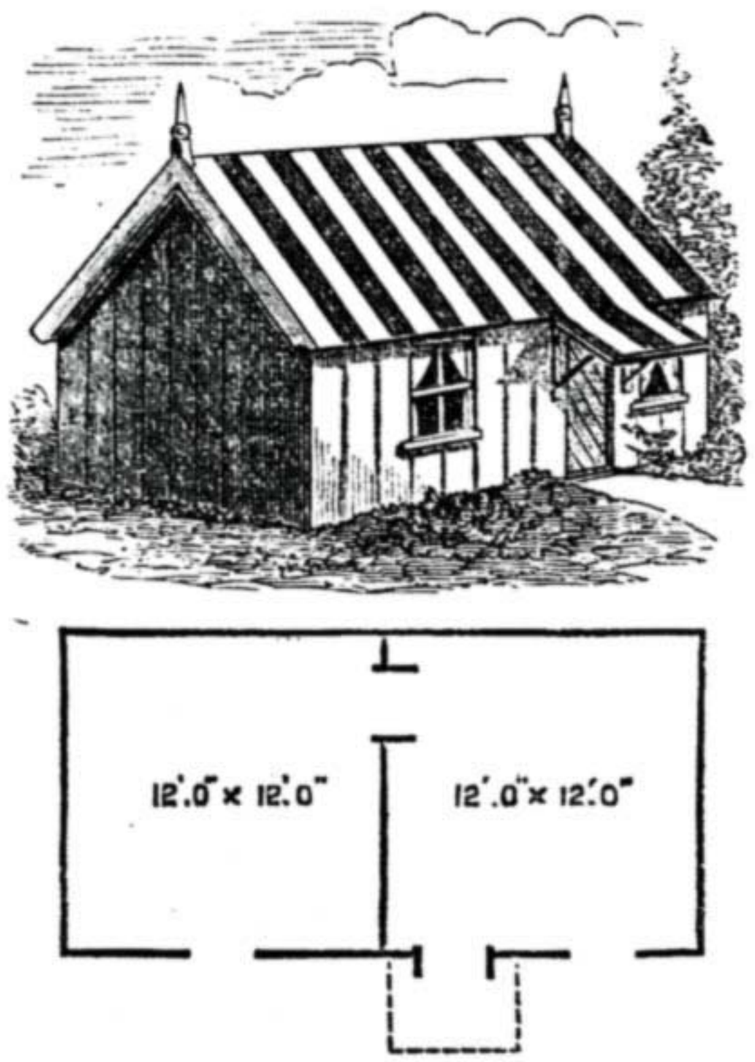
Pulping Paper.—HARRY.—As it is presumed that HARRY does not propose to set up regular pulping apparatus, he is advised to soak his scraps of paper for several days and then to pound them in a mortar. Boiling for a while before pounding will facilitate the pulping. If in pounding it is found necessary to add so much water as will make the pulp too thin, any superfluous moisture may afterwards be easily squeezed out.—S. W.

Guards for Electric Lamps.—W. R. P. (*Kentish Town*).—Are lamps are enclosed in a wire netting to protect the light and the glass globe from accidental injury by birds flying against the light or substances thrown at the light. The netting also protects persons and property from injury caused by falling pieces of glass in the event of rupture to the glass globe. Large incandescent lamps are also similarly protected, for the same reason.—G. E. B.

Removing Discolorations from White Marble.—B. X. E. (*London*).—Make a strong solution of American potash, stir in powdered whiting so as to form a paste, and paint the mixture over the marble. If washed off in a few minutes it will bring with it ordinary discolorations, but deeper stains may require that the mixture should remain on for several hours. It should not remain on longer than is necessary, as the caustic potash has a tendency to injure the surface of the marble. That potash should be used which is bought as a somewhat moist powder, not that which is bought in hard lumps. There are some stains, such as those said to be caused by the urine of dogs, etc., which resist all efforts to remove them.—M. M.

Paquelin Lamp.—NED.—In Vol. I., No. 32, page 505, will be found the first mention of the Paquelin blow lamp: there is a sketch of it with direction for use; and in Vol. II., No. 57, page 78, there is a more detailed account, giving sectional drawings and full particulars of its construction.—R. A.

Wooden House.—P. I. (*Leytonstone*).—I do not think you will be able to build yourself a house of the size you name for much under £40, especially as you want it to last ten years. Before deciding what material you will cover it with, I should advise you to call at the Patent Wire-wove Waterproof Roofing Co., Limited, 108, Queen Victoria Street, London, E.C., and I have no doubt they will give you some useful information. It is claimed for this material that it resists sun, and is not one quarter so heavy as galvanised iron, both of which



Wooden House: Design and Plan.

are great considerations in your case. As regards construction, whatever covering you use, I should not be persuaded to use any timber under the scantlings given below:—

Ridge-board	1½ in.	by 7 in.
Rafters	2½ ,,	4 ,,
Plates	4 ,,	3 ,,
Posts (door and corner)	4 ,,	3 ,,
Uprights	2 ,,	4 ,,
Sills	4 ,,	3 ,,
Sleepers	6 ,,	4 ,,
Piles, if necessary ..	6 ,,	6 ,,

If possible, bed the sleepers on concrete or brick foundations, keeping the floor of house at least 12 in. above the ground. I send you a little sketch of one of the above Company's houses, showing the material used both for roof and sides. I am glad you are pleased with WORK, and hope you will show your appreciation by trying to circulate it in your new home.—E. D.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—MICROPHONE; E. P. (*Stroud*); NEMO; F. J. B. (*Bristol*); SCULPTOR; MUSICUS; BURNT ONE; C. W. (*Kilburn*); E. P. (*Hackney*); C. B. (*Bloomsbury*); W. H. S. (*Crieff*); A. M. (*Frome*); W. H. T. (*South Hackney*); W. R. S. (*Brixton*); A. S. (*London, W.*); W. B. (*Whitfield*); J. S. (*Deptford*); J. P. (*Wolverhampton*); W. S. (*Ipswich*); J. G. W. (*London, N.*); D. S. (*Aberdeen*); C. P. L. (*Bradford*); A. R. B. (*Dublin*); J. S. W. (*Macclesfield*); TIMA; R. E. H. (*North Wales*); R. A. D. (*Forest Hill*); G. D. P. (*Aberdeen*); F. J. D. (*York*); T. G. (*London, S.W.*); A. S. (*London, N.*); B. (*Ascot*); A. J. W. (*Essex*); F. H. (*London, S.E.*); W. M. (*Oldham*); J. B. (*Sunderland*); D. R. (*London*); T. P. (*Woolwich*); COUNTRYMAN; A. R. (*Newry*); J. E. B. (*Dalston*); URGENT; R. A. C. (*London, E.C.*); F. C. (*Ulverston*); T. H. (*Tooting, S.W.*); G. F. W. (*Birmingham*); G. B. (*London, N.W.*); B. J. (*South Wales*); J. T. (*Hull*); F. J. (*Ireland*); G. T. H. (*Poplar*); A. G. A. (*Sand Pits*); C. B. (*Islington*); D. B. (*Glasgow*); J. T. (*Bedford*); H. G. (*Stoke-on-Trent*); 'PRENTICE BLACKSMITH; DICK; J. L. (*Manchester*); J. R. D.; P. B. (*Stromness*); TRANCAR; A. B. (*Suffolk*); SPAR; TRIPOD; F. C. (*Cardiff*); R. H. (*Bradford*); CONSTANT READER; G. H. (*Paddington*); W. T. H. (*Redhill*); T. H. (*Wandsworth*); W. R. O. (*Llandudno*); J. K. (*Bethnal Green*); INDEX; PAINTER; VICTOR CYCLE CO.; J. R. (*Edinburgh*); J. S. B. (*Plymouth*); H. J. T. (*West Ham*); A. S. (*London, S.W.*); R. F. (*Hamilton*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK No. 70.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in page 290 (No. 70) of this Magazine:—

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FIRST PRIZE	Two Guineas.
SECOND PRIZE . . .	One Guinea.
THIRD PRIZE	Half-a-Guinea.

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Competitors should send in Drawings or Models not later than September 30, 1890, addressed, carriage (or postage) paid, to

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Tools, Tools, Tools.—The cheapest house in the trade for English and American tools is LUNT'S, 297, Hackney Road, London, E. Send stamp for reduced price list. [6 R

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Splendid Safety Bicycle for disposal; brand new; perfect condition; this year's make; ball bearings; usual parts beautifully plated. Must sell; cash wanted. Cannot fail to give satisfaction. Sacrifice for £6 to immediate buyer. Rare bargain.—CYCLIST, 34, Hill St., Ipswich. [2 S

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Grandfather Clock.—Works; no case; complete except weights. Brass face; fair going order, 30s.—KING, 248, Goldhawk Road, London, W. [4 S

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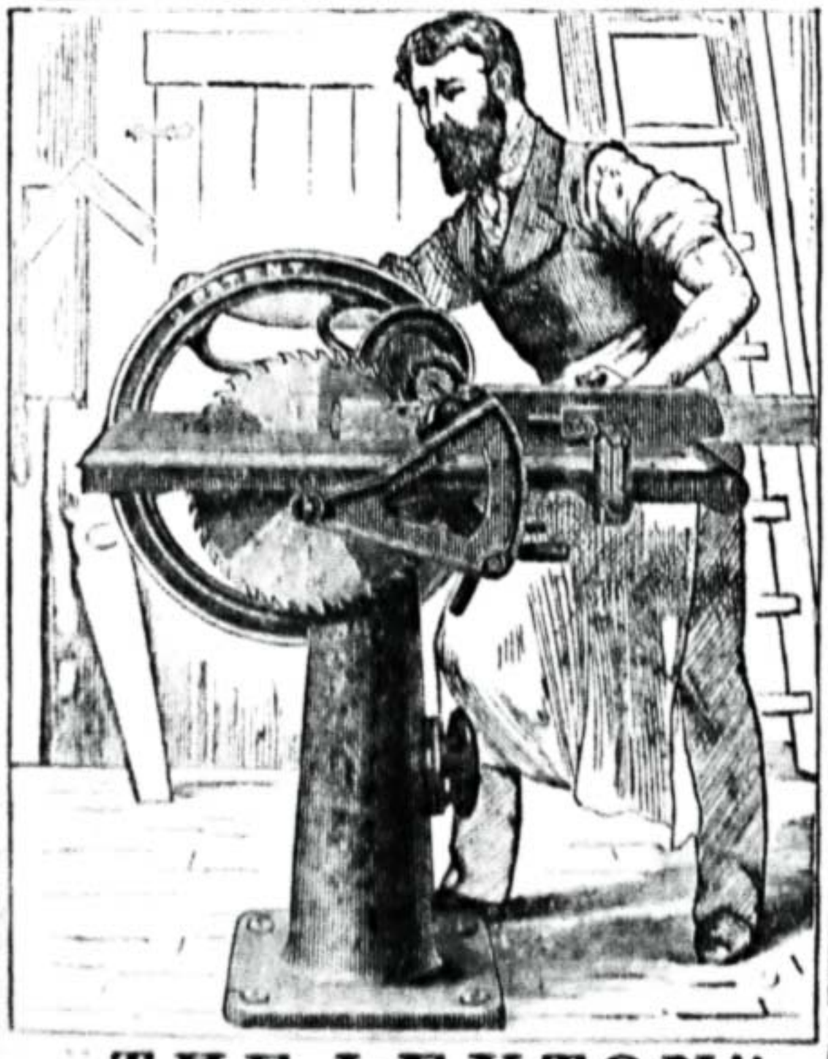

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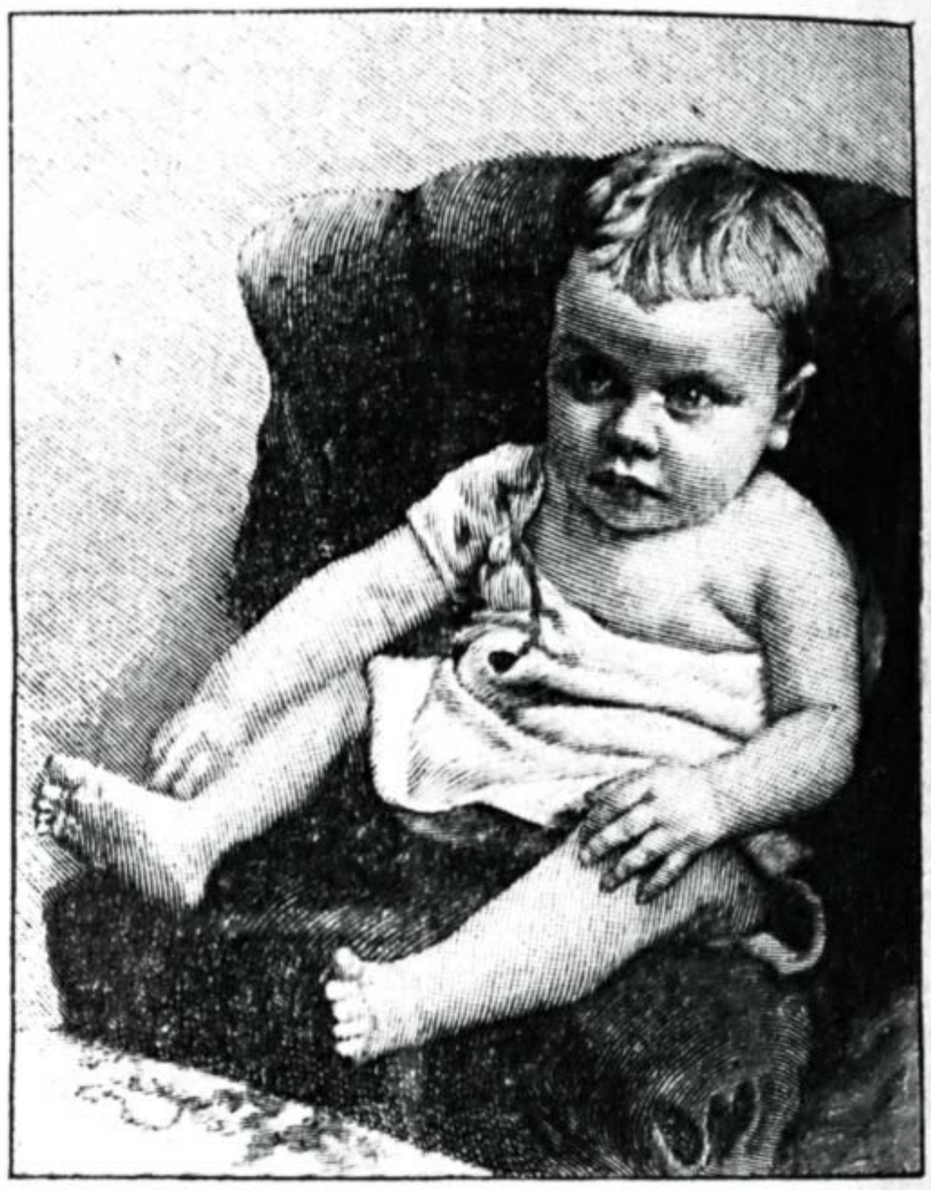

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